SCIENTIFIC AMERICAN SUPPLEMENT. No. 1127

Scientific American, established 1845.
Scientific American Supplement, Vol. XLIV. No. 1127.

NEW YORK, AUGUST 7, 1897.

Scientific American Supplement, $5 a year.
Scientific American and Supplement, $7 a year.

THE CANET RAPID FIRE ARTILLERY.

I. NAVAL GUNS.—M. Canet, now superintendent of the Creusot artillery, after persevering experiments and successive improvements, succeeded a few years ago in constructing a complete naval artillery material, the superiority of which over all others has been demonstrated by experience.

Such material is organized upon the following principles: The bore of the gun is of great length, ranging from 45 to 50 and even 80 calibers. The contours give ample security against flexions or bursting of the chase, a chamber of large size permits of using quite a strong charge, and, by reason of the length of the bore, the initial velocity may reach 800 and even 900 meters per second.

The breech piece is a cylindrical screw, the simple and rapid maneuvering of which is done by a single movement of a lever. It is provided with safety apparatus to prevent a permature discharge and the unscrewing of the breech piece. The extraction of the shells is done progressively by means of a claw, which grasps their base.

The carriage, which is simple and strong, is provided with a hydraulic brake of constant pressure, with a recuperator that permits of obtaining a return to battery sufficiently rapid and without any shock. It is balanced around axes of rotation in such a way as to reduce the stresses of pointing. It permits the piece to recoil according to its axis, whatever be the angle of fire. This material, which is perfectly elaborated in all its parts, and which embraces in its arrangements of detail the latest improvements, comprises guns of 10, 12 and 15 centimeters.

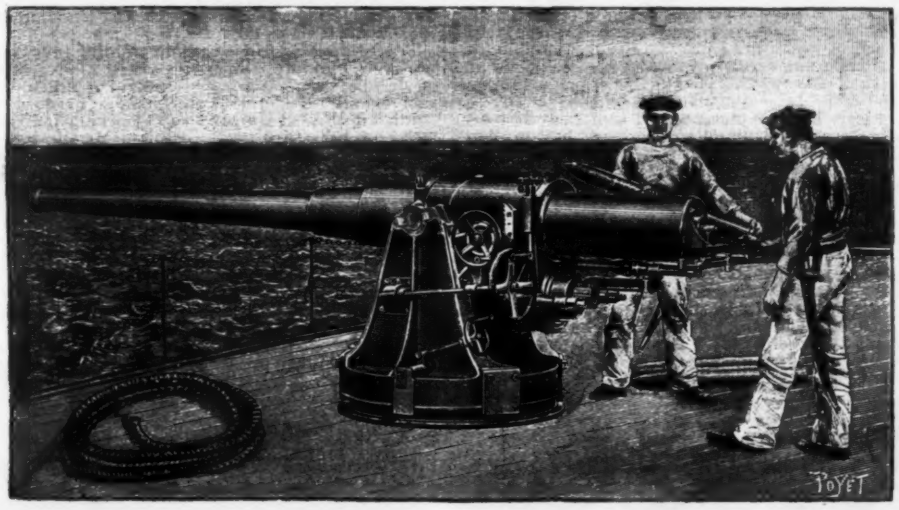


FIG. 1.—CANET 10 CM. RAPID FIRE NAVAL GUN—MODEL OF 1888 (48 CALIBERS.)

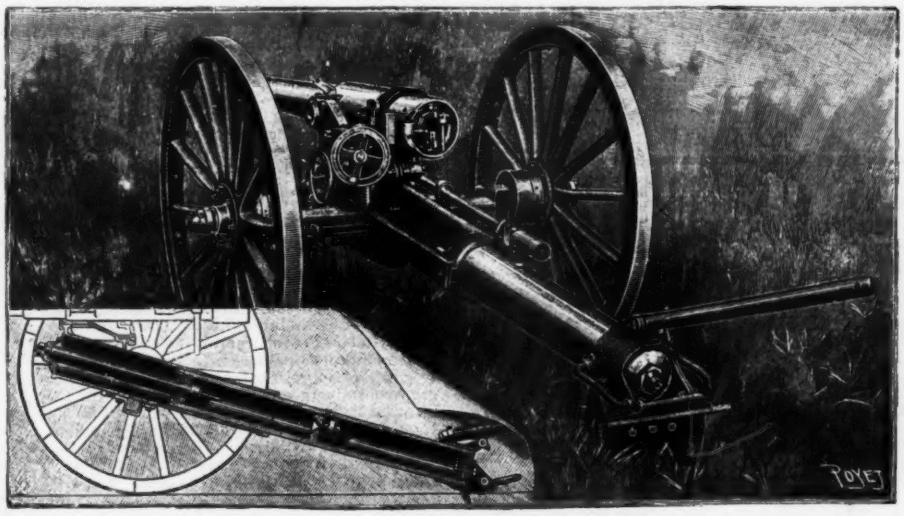


FIG. 2.—CANET 75 MM. RAPID FIRE FIELD GUN.
Piece in firing position. Section of carriage with elastic mounting.

The gun is wholly of steel, and is formed of a tube that extends throughout the length of the piece, of a jacket which rests in the rear against a shoulder piece, and of a conical ring that prolongs the jacket in front. The chamber, in the form of a truncated cone, is united with the cylindrical part through a reinforcing sleeve, and the grooves preserve a constant width up to the muzzle. Their inclination varies from 0 to 6°.

The breech mechanism permits of effecting the three motions of rotation, withdrawal and turning back the breech block at the side through a maneuvering of the screw by a simple movement of the lever in a horizontal plane. The breech is opened through a motion of the maneuvering lever from right to left. At the beginning of the motion, the revolution of the lever around the pivot unscrews the block. The teeth of a bevel gear placed in the posterior cavity are carried along by a pinion with vertical axis fixed to the bracket of the breech block. At the same time, a wheel traverses the circular part of the slide, and a cam carried by the pivot abuts against the posterior edge of the block seat. If the action upon the lever be continued, the pivot as well as the breech screw will be pulled backward. At the end of the motion, the entire system, having become interdependent, will pivot around the axis, and the breech will be open. The closing is likewise effected through a single motion, but in an inverse direction. The firing may be done either mechanically by means of a percussion primer or by electricity.

The carriage has a central pivot and is of limited recoil, with an automatic device to bring it into firing position again. It comprises (1) a sleeve which surrounds a portion of the reinforce of the gun; (2) an oscillating frame upon which the sleeve rests; (3) the carriage, properly so called, of cast steel, formed of two cheeks that support the trunnions of the frame; and (4) of a cast steel base bolted to the deck of the ship and the center of which carries a column of Belleville springs, which are compressed during the firing. The hydraulic brake that limits the recoil and brings the piece back to the firing position is of what is called the "central counter rod system." It consists of a cylinder, of a piston whose rod is fixed in the head, of a valve resting upon the back of the piston through the pressure of springs, and of a rod that enters a central orifice formed in the piston.

The recuperator consists of a piston surrounding the piston rod and of a cross piece carrying two columns of springs.

At the moment of firing, the gun recoils in the sleeve, carrying with it the head and, consequently, the piston. The liquid contained in the brake cylinder is then forced to the front of the piston and passes through the annular orifice between the edges of the central aperture in the piston and rod, whose variable profile permits of regulating at each instant the section of such annular orifice and, consequently, the pressure developed. It afterward passes through orifices formed in the piston and lifts the valve. The recoil of the springs brings the gun back into firing position in forcing the liquid to the end of the piston. The projectiles are of two kinds—an ordinary cast iron shell and a bursting shell of chrome steel. Their brass cartridges, closed at the base by a screw plug, contain the charge of powder.

These guns require but four or five men to maneuver them. They permit of doing the firing with a rapidity that may reach from ten to twelve shots a minute, when no pointing is done, and five or six shots a minute when pointing is done at every shot. The 12 cm. gun throws a 35 kg. projectile with an initial ve-

FIG. 3.—THREE SYSTEMS OF CANET BREECH MECHANISM.
1, 2, 3, 4, arrangement of breech piece with cylindrical screw; 5, 6, 7, 8, 9, arrangement of breech piece with conical screw; 10, 11, 12, 13, arrangement of breech piece with concentric threads.

locity of 780 meters per second, and the 15 cm. gun throws a 66 kg. one with an initial velocity of 750 meters per second.

II. Field Guns.—The construction of a rapid fire field gun constitutes a problem that is far more complicated than that which concerns a naval, place or siege piece. Nevertheless, after some comparative studies and experiments in firing carried on almost uninterruptedly since 1889, M. Canet has succeeded in constructing a rapid fire field material, all the elements of which have been perfectly combined, and which affords a remarkable solution of the problem from the standpoint of power, mobility and rapidity of firing.

The principles upon which the construction of this material is based are as follows:

The gun, which consists of a tube, reinforced by a long sleeve that receives the breech of a fixing ring and of a ring carrying the trunnions, presents every guarantee of resistance in the longitudinal as well as in the transverse direction.

Three systems of screw closing permit of obtaining rapidity in the maneuvering of the breech block. One of these, which has a cylindrical screw, and the simplified parts of which are capable of being manipulated almost instantaneously without any tool, opens and closes the breech by two successive motions of the lever without releasing the maneuvering handle. The second, which has a conical screw, is maneuvered very rapidly, by a single motion of a lever in one plane. The third, with concentric threads, and entirely new, is maneuvered very simply by a single motion of a lever. The three systems are provided with automatic extractors, that assure the ejection of the brass cartridge shells. All three are equally well adapted for the use of percussion or electric primers. The carriage constitutes a genuine innovation. It is distinguished from the rigid systems in that it almost completely suppresses the lifting and reduces the recoil to a minimum, its length being variable, the fixed part being reduced to the stock, and almost the entire weight participating in the recoil of the piece. The projectiles are separated from the cartridges during carriage, and are inserted rapidly at the moment of firing.

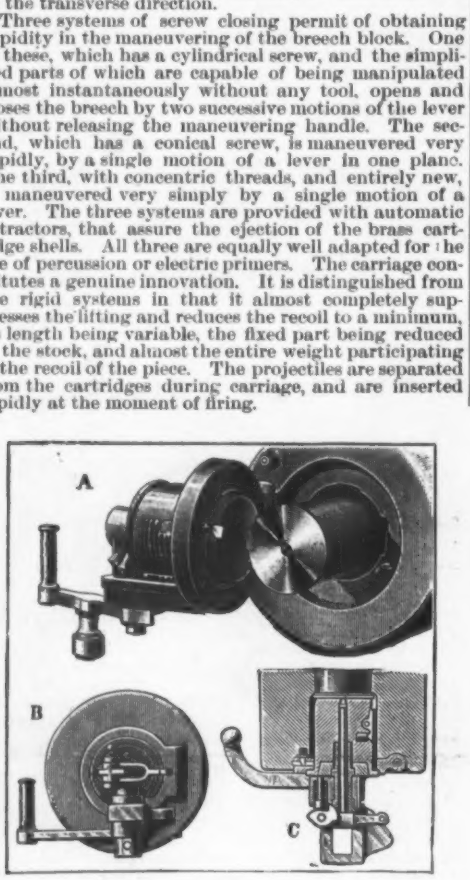


Fig. 4.—BREECH MECHANISM OF THE 10 CM. GUN.

A, the breech open; B, front view; C, horizontal section.

The rapid fire field artillery of the Canet system, model of 1896, comprises the following guns:

	Heavy material.	Light material.
75 mm. caliber..	Gun of 30 calibers.	Gun of 24 calibers.
70 " ..	" 30 "	" 24 "
65 " ..	" 35 "	" 30 "

The carriage, with elastic tubular mounting, of these guns consists of two principal elements. One of these, which is stationary during the firing, consists of the trail plate and the stock; and the other, which is movable, comprises the part of the frame that slides upon the tubular mounting during the recoil and the return to the firing position, the carriage properly so called, the axle and the wheels.

The stock is formed of a forged steel tube containing a hydropneumatic brake and which enters the tubular mounting after the manner of a telescopic tube. At the end it carries, screwed on firmly by a ring, a trail plate and its accessories.

The tubular mounting carries a circular plate cast in a piece with it upon which rests the gun frame. The latter has two cheeks which are strongly cross-braced and connected beneath by a circular plate that corresponds to that of the tubular mounting. The surfaces in contact are trued up with great precision, so as to permit of pointing without any effort.

A maneuvering hand wheel, through an endless screw, moves the toothed sector fixed to the mounting and permits of giving the gun the motions for training in horizontal direction. A second hand wheel, a little to the rear and at the side, controls the mechanism for training in a vertical direction through the intermedium of a pointing box and a vertical screw. The axle, which is of forged iron, and curved at the center, is cranked at its extremities in order to permit of the use of wheels of wide diameter.

The hydropneumatic brake in the interior of the steel tube is of a very simple and strong type that assures the regularity of its operation and requires no looking after.

At the first shot the trail plate enters the earth. An insignificant recoil that does not exceed 50 millimeters, and that varies, moreover, according to the hardness of the ground, occurs at the first shot, and then the trail plate and stock are rendered immovable. At every shot the entire movable part freely recoils, and the tubular mounting slides upon the stock and actuates the brake without the wheels leaving the ground. Then, the energy having been absorbed, the return to a firing position takes place and the carriage resumes the position that it previously occupied. The ammunition is of an entirely new type. The sole projectile is a shrapnel formed of a steel shell containing a series of cast iron disks in which are embedded balls of hardened lead. A central tube permits the fuse to communicate with the charge behind. Around this tube is rammed down an inexplosive material which, at the moment of the bursting, gives out a thick cloud of smoke (visible at a great distance), and which is capable of setting fire to combustible substances. Steel shells of large capacity, with a solid point and with a slow fuse designed to retard the bursting, are reserved for the attack of fortified works. The cartridges are stamped in a single piece out of brass or aluminum. At the base they carry either a percussion or an electric primer.

The Canet guns may be fired with smokeless powder having either nitroglycerine or guncotton as a base. The initial velocity reaches 500 meters in short guns and 600 in long ones of the type of 75 mm. The weights of the guns are respectively 250 and 330 kg.; those of the carriages are 500 and 650 kg.; and those of the shrapnels are 4·6 and 5·2 kg. The maximum range is 5,000 and 6,800 meters.

The rapidity of the firing, in training every time, is ten shots a minute. Such are the principal elements of this material. We cannot enter here into a description of all the details, which have been carefully studied in view of the object to be attained. The material has been submitted to prolonged rolling tests at all speeds over paved roads, and to numerous experiments in firing, at the Hoc proving grounds, and has in all cases behaved admirably.—La Nature.

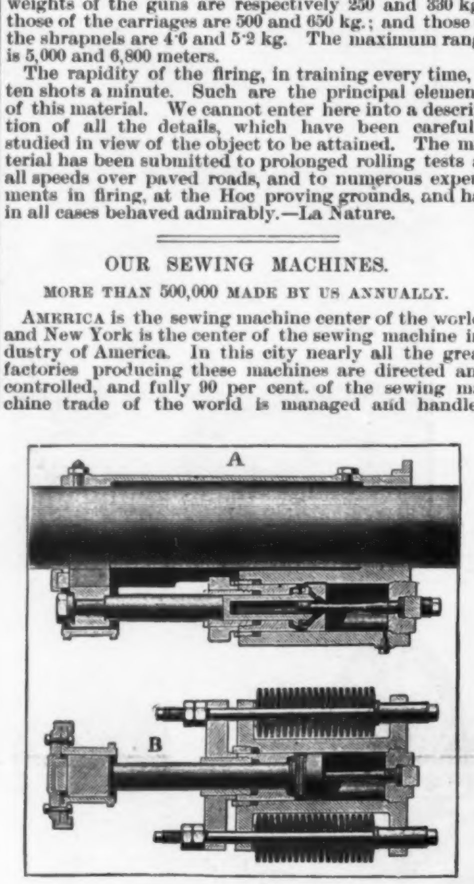


Fig. 5.—HORIZONTAL BRAKE WITH CENTRAL COUNTER ROD AND ITS RECUPERATOR.

A, longitudinal section; B, vertical section.

OUR SEWING MACHINES.

MORE THAN 500,000 MADE BY US ANNUALLY.

America is the sewing machine center of the world, and New York is the center of the sewing machine industry of America. In this city nearly all the great factories producing these machines are directed and controlled, and fully 90 per cent. of the sewing machine trade of the world is managed and handled here. The production amounts to more than 500,000 machines annually, and nearly 100,000 persons in one way or another make their living out of sewing machines, either as factory operatives, agents, clerks, canvassers, collectors, or in some other capacity connected with the making and marketing of machines. One of the largest of the companies has an agency of its own in nearly every city, town and village in the United States, besides being represented by its own agents in every city of importance throughout the world.

The American sewing machine, like the American watch and the American reaper and mower, is the standard of excellence for the civilized world, and the export trade in sewing machines penetrates to the uttermost ends of the earth. New York is the great sewing machine center of the world, because, in addition to being the headquarters of the industry in the United States, it is the home of a company which operates several factories in Europe, among them one in Scotland, where 6,000 persons are employed. The machines manufactured abroad under American patents are not included in the statistics of the export trade, though their manufacture in Europe cuts off our export trade to that extent. Everywhere throughout Christendom the American sewing machine holds the market against all competitors. It is not a question of price, but of merit, quality and reputation. The only country that is making any headway in the struggle for the sewing machine trade is Germany. There they have gone into it seriously, and are turning out machines that show a great improvement over their product of a few years ago.

"Germany is hot after us for the world's market," said a sewing machine exporter to the Sun reporter, "and she is making such excellent machines that the competition threatens to become important to us. German manufacturers have some facilities which Americans do not have for obtaining advances from their banks upon goods consigned to foreign markets, and they can give their commission men six to nine months' credit on all machines handled by them, and the same credit is extended to the buyers wherever they may be located. Here in New York the sewing machines for export are sold for cash, and no credit is extended to the buyer. We are, therefore, at a disadvantage in this respect, and Germany is increasing her foreign trade at our expense. She is making a strong bid for the South American trade, and is meeting with considerable success. German efforts to sell sewing machines to France have not fared so well. No matter how cheap the price or how long the credit, the Frenchmen will not buy of their enemy, but keep on taking American machines."

The money value of sewing machine exports for the year 1895, and for the thirty years ending with 1895, was as follows:

	1895.	Total for 30 years.
Austria-Hungary	$12,160	$81,709
Belgium	36,200	780,846
France	98,566	2,645,045
Germany	472,203	15,417,683
Holland	22,618	403,800
Italy	8,756	204,821
Portugal	77	15,039
Russia	....	130,580
Spain	1,314	78,977
Sweden and Norway	8,919	101,658
Switzerland	100	8,729
Turkey	137	25,685
Great Britain	645,847	22,952,623
British North America	111,388	2,123,023
British Australasia	224,875	4,425,056
British West Indies	13,628	241,136
Hayti	4,906	123,428
San Domingo	1,817	70,908
Cuba	16,114	2,241,264
Dutch West Indies	1,069	68,841
Denmark	1,958	34,161
French West Indies	1,849	32,239
Porto Rico	2,230	212,768
Mexico	132,841	4,018,182
Central America	64,976	903,967
British Guiana	3,189	21,182
Dutch Guiana	324	1,644
French Guiana	1,314	5,911
Colombia	39,924	2,620,533
Bolivia	830	3,329
Ecuador	11,492	147,249
Brazil	140,054	2,310,249
Argentina	53,504	1,481,760
Uruguay	13,317	829,784
Venezuela	46,248	979,615
Peru	8,609	493,712
Chile	21,894	569,122
Africa	7,823	162,681
China	3,001	90,817
Japan	3,465	91,632
Hawaii	9,968	269,649
East Indies	1,363	48,028
All other countries	9,277	276,378
Totals	$2,260,189	$67,245,243

For 1896 the total exports were $3,051,168, a gain of $791,039 over the preceding year. There was an increase in the sales to the United Kingdom, British Australasia, Africa, Germany, France and some of the South American countries, and a slight falling in the number of sewing machines sold to Canada. The figures relating to France include only the sewing machine heads, as under the high retaliatory duty enforced in France against American products it is not found profitable to export the iron stands and wooden cabinets. For February, 1897, the total value of machines exported was $244,796. Cuba, which in 1895 took $16,114 worth of sewing machines, in 1896 fell off to $3,661, and this was mostly for attachments, needles, etc. The unhappy Queen of the Antilles, wrapped in the horrors of war, has had little use for anything but food, firearms and ammunition.

The annual average of sewing machine exports during the past ten years has been over $2,500,000 in value. This does not include the 200,000 machines made annually in the Scotch factory already referred to. The same company operates a factory with 4,000 employes at Elizabethport, N. J., and a curious confirmation of the vaunted supremacy of American over foreign labor is found in the fact that the 4,000 Yankees in New Jersey turn out as many machines as do the 6,000 Scotchmen at Kilbowie. Of the total of 13,500,000 machines made by this company from 1853 to the end of 1896, nearly 6,000,000 have been made in factories located abroad, but directly controlled and managed by the New York company. The average value of the exports of sewing machines from the United States indicates that about 150,000 machines are exported annually, and the total number of American machines sold annually in foreign countries, including those made abroad, is equal to the sales in the United States by all the American companies.

"The export trade has been the salvation of the sewing machine industry in the United States," said the president of one of the leading companies. "During the financial depression of the last four years there has been a marked decrease in domestic sales, and sharp competition has affected prices unfavorably. There has been cutting of prices in all directions, and some of the biggest companies have taken a hand in it. The sale of sewing machines at cut prices by the large department stores has had a demoralizing effect, and it is not to be denied that some very excellent machines are being marketed in this way at low figures. So far the big standard companies have kept their machines out of the department stores, but they would have found it difficult to keep their factories running on full time if it had not been for the export demand."

There have been great fortunes made and great fortunes missed in the sewing machine industry. Elias Howe realized over $1,000,000 in royalties and license fees for his inventions and improvements, and Isaac M. Singer lived to see the business of which he was the founder develop into colossal proportions from the investment of $40 and no end of patience, perseverance and skill, from which the sewing machine industry started a little less than half a century ago. Other men have grown rich in the business, and from its development and operation vast additions have been made to the wealth and prosperity of the country. Howe and Singer seem to have been the only ones among the earliest inventors who reaped substantial rewards. The others lacked the faith and persistence to perfect and utilize their ideas, and so missed their great chances in life.

As long ago as 1851 New York became the sewing machine center of the universe, and has steadily maintained that position to the present time. Factories were located in other cities, but their headquarters were in New York, and the commercial end of the business was always transacted here. At an early date

Orlando B. Potter became identified with the sewing machine industry, but he retired in 1875, several years before his death. In the litigation growing out of the infringement of Howe's patents, Messrs. Jordan & Clark, a New York law firm, were employed as counsel by I. M. Singer & Company in 1851. At that time Ambrose L. Jordan was attorney-general of New York State, and the sewing machine suits were looked after by his partner, Edward Clark. The clients were too poor to pay the large costs and counsel fees which accrued in the course of the litigation, and in payment for his services and for money advanced Mr. Clark accepted an interest in the firm, and in 1852 took charge of the legal and financial branch of the business. It was he who, in 1856, instituted the system of selling sewing machines on the installment plan. This, it is believed, was the inception of a system that has now become universal and all-embracing in its scope. From 1876 to 1882, the date of his death, Mr. Clark served as president of the wealthy and prosperous corporation which he had served as attorney in its impecunious days.

It is now twenty years since the expiration of the last important patent on a fundamental principle of the sewing machine; but the inventive genius of the age has not been idle all this time, and patents covering devices of greater or less utility have been granted in large numbers. From February 21, 1842, to September 10, 1895, there were issued by the United States 7,439 patents for sewing machines and accessories. Many of these patents cover several minor features of the sewing machine. So that the aggregate of patented inventions is much larger than 7,439. Among the patents issued during the fifty-four years ending with 1895 were the following:

Sewing machines making the chain stitch	433
Sewing machines making the lock stitch	661
Sewing machines for stitching leather....	431
Machines for sewing on buttons.........	33
Machines for making buttonholes	448
Feeding devices........................	316
Miscellaneous parts of sewing machines..	2,950
Attachments, rufflers, hemmers, corders, etc..................................	1,524
Cabinet cases and tables....	473
Motors, foot, hand, steam, electric......	170

The earlier machines had no driving power except the common hand crank. This involved the use of the right hand, and only the left hand could be used for managing and guiding the material to be sewed. Isaac Singer conceived the idea of using a treadle similar to that employed on the old spinning wheel, and also discovered that with the addition of a balance wheel on the upper shaft for increasing the momentum he could run his machine by foot power. Soon after came the iron stand with the rocking treadle for both feet. Mr. Singer missed a great chance here. He did not realize the supreme value of these discoveries, and so neglected to take out patents. Two years later, when his devices had become public property, he saw the lost opportunity. One of the latest devices for driving a sewing machine is a revolving treadle with the bicycle movement, but none of the new wrinkles have proved so satisfactory as the old fashioned rocking treadle.

The proportion of hand to foot power sewing machines used in Europe and in Asiatic countries is far greater than in the United States. The operation of a sewing machine by hand power in this country is exceptional and is usually confined to those in some manner crippled or physically unable to apply foot power. In Europe and Asia much of the sewing machine work is done by peripatetic operatives who travel from house to house and carry along their own machines, and as they find the iron stands and wooden cabinets an impediment they prefer the hand power machine that can be rested on a table, bench or box.

In no branch of manufactures has a greater revolution been wrought by the sewing machine than in boots and shoes. By its aid the quality, style, and value of footwear have been greatly enhanced, while prices have steadily declined, until there is no nation on earth to-day whose people are so well and so cheaply shod as are the people of the United States. Changes in shoemaking methods and processes have been most radical. Formerly the fitting of the uppers was accomplished by sending them out in small quantities to be sewed and stitched by hand in the homes of the operatives. When sewing machines were introduced the scattered home industry was concentrated in factories, and steam power was employed for driving the machines. In 1861 the first machine for sewing on soles was put into successful operation, and a royalty of two cents on each pair of shoes was exacted by the owners of the patent. They must have had a liberal income from this source, as in one day of ten hours 900 pairs of shoes could be sewed on one machine, and by the aid of machines 350,000,000 pairs of shoes had been made up to the year 1877 in the United States, and probably an equal or greater number in Europe. The machine now in general use does its work in a manner closely resembling hand sewing, and is sold on a royalty plan based on the rate of production. This machine is considered one of the marvels of an age of mechanism. It is said that after examining the operation of the sewing and welting machine of to-day Thomas A. Edison declared it to rank equal with the Blanchard lathe in ingenuity and importance. Certain it is that a shoe which can be bought at retail for $3 is in all respects equal and in many respects superior to the $5 shoe of fifteen or twenty years ago. Another effect of machinery has been to greatly increase the finish and beauty of ready made shoes.

Button hole machines have also had a large sale on the royalty plan, and have been very remunerative to the owners of the patents.

During the early years of the sewing machine, the custom tailors showed great prejudice against its use, but this prejudice has wholly disappeared, and the machine is now in general use for making the finest garments. The enormous increase during the past ten years in the factory production of clothing has been coincident with and largely the result of the invention of special appliances and attachments adapting the sewing machine to factory operations in the performance of all stitching processes, including button hole and eylet making, attaching buttons, staying seams, etc. From 1880 to 1890 there was an increase from 6,166 to 18,658 in the number of establishments in the United States devoted to the manufacture of men's clothing, and during the same decade the number of establishments devoted to women's clothing increased from 562 to 20,811. The last mentioned figure includes custom dressmaking establishments having a product of over $500 in value, whereas the smaller figure for 1880 does not include the custom dressmaking establishments.

The concentration of the manufacture of clothing into factory operation, alone made possible by the sewing machine, has effected some important economics in the marketing of the cloths, especially the cheaper fabrics, such as jeans, denims, shirtings, etc. These goods are now sent directly from the mills to the factories where overalls, shirts and other articles of clothing are made, and no longer pass through the hands of the selling agent, the commission man, the wholesaler, the jobber and the retailer, each of whom formerly enjoyed his slice of profit in the handling. The extent to which wearing apparel of all kinds has been cheapened in consequence of the sewing machine could be expressed only by figures running far into hundreds of millions.

It is also an interesting fact that while the large manufacturing industries dependent upon the sewing machine much more than doubled their output from 1880 to 1890, the population of the country only increased one-quarter. It therefore follows that the quantity of sewing done in the home has been greatly reduced and the cost to the consumer of sewing machine products greatly lessened. A man well informed in the sewing machine trade on a large scale said to the Sun reporter:

"It is in the use of sewing machines in factories that the greatest revolution has been effected. You will doubtless be surprised when I tell you that the sewing machine in the home, taking the rich, the well to do, the families of the well paid wage earners, and the poorest of the poor altogether, does not average over twenty hours in the whole year. It is no longer used at home for making garments; the factories produce these at a price so little in excess of the cost of the cloth that it is no object for the housewife, be her circumstances ever so straitened, to employ her time in making clothes for the members of her family. Women at home use their sewing machines only for an occasional bit of stitching, and while none of them would consent to be without a machine, the use of it is surprisingly small. This is one of the greatest boons conferred upon women by the sewing machine, for it has left them leisure for other employments or enjoyments."

In the census reports relating to the principal manufacturing industries that use the sewing machine largely, the figures show that the total value of their products in 1890 had increased about 75 per cent. as compared with the value of their products in 1880. These industries employed 661,000 hands in 1890; they had about $437,000,000 invested in machinery, tools, and implements of all kinds, and the total value of their product was $1,161,196,659. The manufactures in which sewing machines are essential are awnings, tents, sails, bags, bookbinding, boots and shoes, clothing for men and women, corsets, flags, banners, men's furnishing goods, gloves, mittens, hats, caps, pocketbooks, rubber and elastic goods, shirts, saddlery and harness, and horse clothing.

The reports of the sales of sewing machines during 1873-76, the period of the "sewing machine combination," which was entered into by the leading manufacturers twenty-four years ago, show a total of 2,203,941, the average a year being about 576,000. Since 1876 there has been no available information other than that indicated in the census reports. These figures indicate that the average number of machines made annually during the last twenty years in the United States has been from 500,000 to 600,000, and that the average first cost per machine has been about $20.

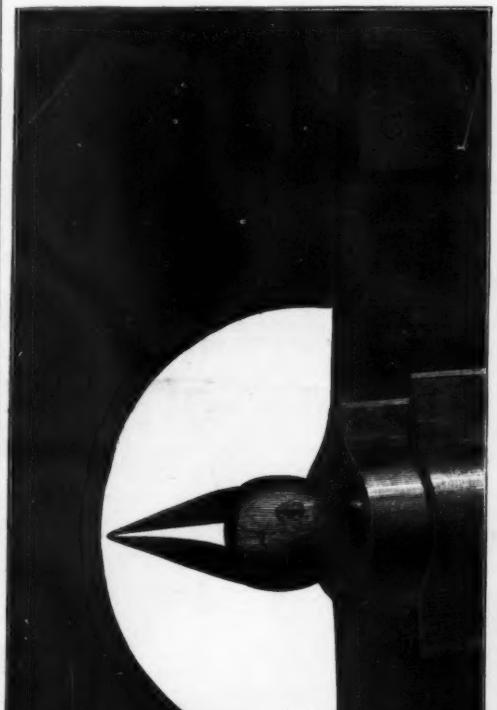
A comparison of the census reports of 1880 and 1890 shows a decrease of 50 per cent. in the number of establishments engaged in the manufacture of sewing machines, but it also shows that there has been no perceptible decrease in the number of persons employed, and that their average wages had increased about 10 per cent. during the decade. In 1880 the average wages were $485, and in 1890, $567 per annum. The reports from fifty-six establishments in 1890 showed the employment of 9,121 operatives, whose wages amounted to $5,170,555. The market value of their product was $12,823,147, so that the item of labor constituted about 40 per cent. of the total value. The relative figures have not changed materially during the last seven years. It is estimated that at present about 10,000 operatives are employed in the sewing machine factories of the United States and that the number of machines produced is but little in excess of 600,000. The average rate of wages is about the same as in 1890.

Nearly all of the large sewing machine factories of the United States are located within a few hours' ride of New York City, and this city is in effect the point of departure of the great bulk of sewing machine shipments. Scarcely a steamship clears from this port for any part of the world but carries one or more American sewing machines, while large numbers destined for China, Japan and Australia are shipped in sailing vessels on account of lower freight rates.

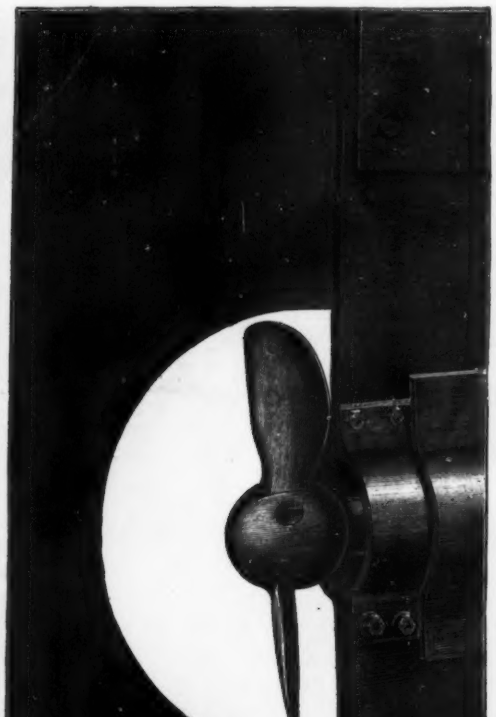
Until recently, the machines sent to foreign countries were of the plainer styles, but within the last year or two, there has come a demand for handsomer frames and cabinets, and the average price paid has increased correspondingly.—New York Sun.

THE SHEATHED PROPELLER.

SINCE the introduction of steam navigation, traffic by sea has undergone as great changes as that by land has experienced since the opening of the first railway line.



THE PROPELLER UNSHEATHED.



THE PROPELLER READY FOR USE.

It has long been a problem to find some suitable contrivance by which sailing vessels might, in times of calm or of contrary winds, by the help of auxiliary engines, continue their course.

Most freight vessels carry both sails and machinery nowadays, but we need not consider these, as the subject of our article concerns smaller craft only.

The Sheathing Propeller Company, of London, has lately put on the market a small propeller of peculiar construction. Our two illustrations, which we have borrowed from Der Stein der Weisen, will serve to show its construction. We see in the first cut the usual semicircular opening in the rudder and the propeller shaft emerging from a steel casing. The propeller itself is not set in position for use, but the two wings or blades are folded in an axial position. To make this possible they are hinged in a spherical head, which, on the side farthest away from the ship, has a slot permitting the two blades of the propeller to move in a plane extending longitudinally of the shaft. In our second cut we have the propeller opened, ready for use. When the ship is sailing by wind or is at rest the whole contrivance can be drawn back into the tubular casing of the shaft. The same company also makes a somewhat similar propeller which is, however, drawn in fully opened into a receptacle of corresponding dimensions. But this modification offers far less advantages. "The first objection is perhaps the considerable space required, which might of course be used for other purposes. Besides, when the propeller is not in use, it causes quite an appreciable resistance, which, of course, lowers the rate of progress attained under sail.

But the first mentioned form will certainly be found most useful by many classes of ship owners.

Sportsmen will, no doubt, object to having on board machinery of any sort, be it only a small benzoline motor. But for fishing smacks, small merchant sail-

ing vessels, and even for large steamers, the folding propeller will be a very advantageous acquisition.

Hitherto steam has been useless as a means of propulsion to fishermen, as the screw or paddle would get caught in the nets and ropes, and not only foil all attempts at pursuing their business, but cause considerable trouble, and perhaps some danger. Such difficulties are avoided by the propeller shown in our cut.

We stated above that it would also be of great use to smaller merchant vessels constructed to carry sails. Such are usually supplied with some machinery for loading purposes, for hoisting sails, moving heavy articles, etc., and these engines would be quite sufficient to work the light propeller; so that the danger of a stoppage in a dead calm, and the commercial loss in such cases, would be avoided. But even if there is no steam power on board, a small motor of any description will do the work quite satisfactorily, and the owner would have an almost unlimited variety to pick from.

As for the advantage gained by providing large steamers with one or several such propellers, it will occur to every one who calls to mind the difficulties that our large vessels have in landing and coming alongside the docks or piers. The cause of all this trouble is that, when the boat is nearly stopped, it no longer obeys the rudder, and so towing has often to be resorted to. If, besides the main propeller, there were two smaller screws, one on each side, this difficulty would be overcome. For, by working only one of them, a curved course might be given to the boat. Besides, of course, there is always a possibility of damage to the main propeller, and in such emergencies the sheathed screws would of course be resorted to. It is also said that the lurching and rolling of fast running boats could to a great extent be mitigated by the use of two auxiliary screws.

The sheathed propeller would then be used with great advantage on all kinds of craft—the fishing smack, merchant sailing vessel, passenger and freight steamer, and even the man-of-war would each be benefited in her own way.

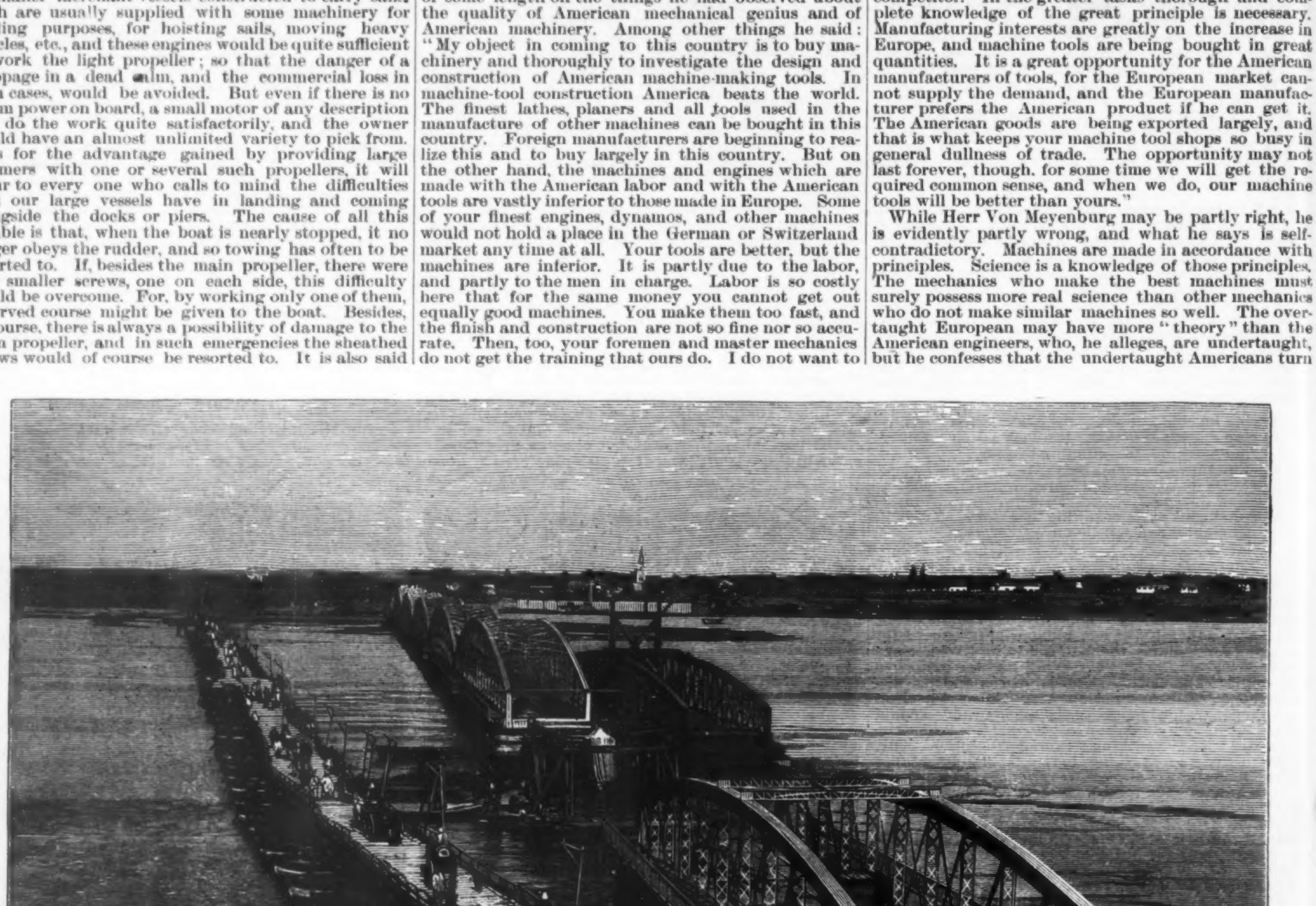
All parts of the screw which come in contact with sea water are made of bronze, gun metal and other appropriate alloys. The company has constructed models of ships fitted with their propeller up to several horse power, providing the inquirer with plans, information and directions concerning the use and installation of its goods.

THE NEW BRIDGE OF ST. LOUIS AT SENEGAL.

A new metallic bridge has recently been completed over the River Senegal, replacing the old wooden pontoon bridge established by General Faidherbe. Both bridges are distinctly shown in the illustration published herewith, for which we are indebted to Le Monde Illustré. The old bridge is a flimsy-looking affair, which might be readily carried away by even a moderate flood. The last section of the new bridge is ready to be floated into position.

The bridge is 600 meters long and was built by the Nogier & Kesler Company, to whom the work was allotted by the Committee on Adjudication. The contract price was 1,500,000 francs.

The illustrations present an interesting contrast of the latest type of bridge construction as compared with the primitive efforts of an earlier date.



THE NEW BRIDGE OF ST. LOUIS AT SENEGAL.

COMMON SENSE AND SCIENCE.

Herr Von Meyenburg, a Swiss engineer who has been making a tour of the machinery manufacturing centers of the United States, visited Worcester, Mass., and gave a representative of a paper an interview of some length on the things he had observed about the quality of American mechanical genius and of American machinery. Among other things he said: "My object in coming to this country is to buy machinery and thoroughly to investigate the design and construction of American machine-making tools. In machine-tool construction America beats the world. The finest lathes, planers and all tools used in the manufacture of other machines can be bought in this country. Foreign manufacturers are beginning to realize this and to buy largely in this country. But on the other hand, the machines and engines which are made with the American labor and with the American tools are vastly inferior to those made in Europe. Some of your finest engines, dynamos, and other machines would not hold a place in the German or Switzerland market any time at all. Your tools are better, but the machines are inferior. It is partly due to the labor, and partly to the men in charge. Labor is so costly here that for the same money you cannot get out equally good machines. You make them too fast, and the finish and construction are not so fine nor so accurate. Then, too, your foremen and master mechanics do not get the training that ours do. I do not want to criticise any one American mechanical school, for they are all alike. A student goes through a course of four years and then is ready to take up his work. In the meantime he has taken a general course in theory and, in addition, has had a smattering of the practical work, a little blacksmithing, a little lathe work, a little welding and a little something else. None of it is complete. In our schools we have a four year course in theory. During that time we do not have a bit of work in the shop, but we study the theory very carefully. We are made to think, instead of gathering a mass of tables and figures in our heads indiscriminately. At the end of the four years we go into the shop and have two years' work there. Then we are ready to take a position.

"As a result, the German master mechanics have a tremendous amount of knowledge and the power to apply it in special cases. But we lack the common sense and personal energy that you have in this country. You have the common sense and quick wittedness, but lack the knowledge of the great principles. It is not the teachers' fault. You have fine teachers here; but the Americans don't want to learn; they don't think. They would rather 'sport,' I think you call it. You don't learn the languages carefully. You think that America beats the world in everything, and that there is no need of studying foreign methods. Now, there are some excellent things in Germany, which can be found out only by reading the original description in German. The reason why American tools are better, while the better machines made with them are found in Europe, is this: Machine-making tools do not involve the great principles that engines, dynamos and great machines do. Tools are really evolved. If a piece is found by experience to be too small, it is made heavier next time. Tools start at a simple stage and are gradually evolved step by step. You, in this country, apply your common sense and make the changes as a matter of course and without much thought, while a German would spend a long time in figuring out the why and wherefore, and would be distanced by his American competitor. In the greater tasks thorough and complete knowledge of the great principle is necessary. Manufacturing interests are greatly on the increase in Europe, and machine tools are being bought in great quantities. It is a great opportunity for the American manufacturers of tools, for the European market cannot supply the demand, and the European manufacturer prefers the American product if he can get it. The American goods are being exported largely, and that is what keeps your machine tool shops so busy in general dullness of trade. The opportunity may not last forever, though, for some time we will get the required common sense, and when we do, our machine tools will be better than yours."

While Herr Von Meyenburg may be partly right, he is evidently partly wrong, and what he says is self-contradictory. Machines are made in accordance with principles. Science is a knowledge of those principles. The mechanics who make the best machines must surely possess more real science than other mechanics who do not make similar machines so well. The overtaught European may have more "theory" than the American engineers, who, he alleges, are undertaught, but he confesses that the undertaught Americans turn out machines that surpass the best products of the overtaught Europeans. If he means anything by this apparently illogical situation, he means that what he calls a "smattering," or too little technical training, is far more desirable and efficient mechanically and commercially than too much technical training, which, according to his view, has stifled "common sense" and dulled the conceptions and perceptions of the unfortunate Europeans subjected to a surfeit of theories. Nor is he any clearer or more convincing in what he says about the products turned out by American and European mechanics. A close comparative study of American and European products in the Columbian Exposition in 1893 absolutely failed to show the European superiority in fineness of work, elegance of design, solidity of construction or perfection of function which Herr Meyenburg claims. Prominent critics awarded the palm of superiority to the American exhibitors there. The German wood and iron working machines shown were models of ugliness and awkwardness, which no American shop would accept as a gift under the provision that they must use them. More than one European engineer, who came to the United States hearlded by a great blare of trumpets to revolutionize mechanical work here and show the natives how to do it, has utterly failed, and has either returned to Europe, where "theory" stands in higher regard than "common sense," or else is occupying some obscure position here. It would be unkind to mention specific cases, but we are not willing to let pass such assertions as those of Herr Meyenburg without a comment. The American system of training may have its defects, but certainly it has in it no defect that implies the smother-

ing of common sense. The European system of training may have no defects, so far as it goes, but evidently it needs to go further, and, instead of submerging its victims under a flood of inapplicable theory, have added to it the elements needed to arouse the sleeping "common sense" of men whose work, above all things else, is the embodiment of common sense in tools and machines. Herr Meyenburg reasons or unreasons himself into an illogical situation which is a queer commentary on the lack of "common sense" which he so bemoans in the Europeans in general. His elucidations do not elucidate.—American Woodworker.

MOUNT VERNON, MO., July 16, 1897.

To the Editor of the SCIENTIFIC AMERICAN:

DEAR SIR: I inclose in another package two pieces of glass water tube from the engine and boiler of the flour mill at this place. These are taken from the upper ends of the tube. The engineer has followed his business for about thirty-five years and tells me that this place is the first in which the tops of the tubes have eaten away in the manner shown. He says the water here gives no trouble in the boilers, but that the tubes, unless removed, will blow out in about two months, and all will show the same action in eating or wearing away. The packing and shape of the connections with the boiler is of the ordinary kind. We would like to know what is the trouble, and whether the action is a chemical or mechanical one. Observe that the enamel is gone on the outside and above the gum packing, and the inside of both tubes grooved lengthwise. Why does it eat away the outside of the tube first? The water end of the glass is not affected. There is no current of steam or water passing over the end affected.

The engineer and myself both take your paper, and if you will be so kind as to give us a little light on this subject, you will relieve two very puzzled people.

E. M. ESSEX.

[The subject of your query is explained in the following article by Mr. G. D. Hiscox.—ED.]

CORROSION AND BREAKAGE OF WATER GAGE GLASSES.

By G. D. HISCOX.

THE uncertain quality of water gage glasses and their liability to crack and burst is always a source of apprehension with engineers and firemen. The most important part of a water gage is the glass tube, and upon the perfection of its make and composition depends the confidence with which it is viewed. The defects arise principally from the composition and imperfect annealing, which leaves an unequal strain upon their outer and inner surfaces. Another defect is the gradual weakening of the tube by the solubility of the glass in pure water at the high temperature due to the pressure of steam carried in the boiler.

Before the introduction of the Scotch kelp glass tubes to the American market, water gage glasses were made from tubing of Bohemian, crown or flint glass, as convenient; their durability being very uncertain from the brittleness of the Bohemian glass under changes of temperature and the extreme solubility of the flint glass in contact with high pressure steam. The crown glass was better, but could not always be had in tubing. The introduction of the Scotch kelp glass tubes has made the conditions of breakage and wear more uniform, but with no apparent gain in the soluble properties of the glass.

Thus, by a series of experiments, flint glass has been found readily soluble under a pressure of from 300 to 600 pounds per square inch, at a less temperature than that of boiling water; other experiments have shown that pure water as it condenses from steam at high temperatures and pressures is an active solvent of glass in a degree dependent upon its composition, the greatest affinity being toward the kind of glass containing the greater portions of potash or soda.

Several theories have been named to account for the wearing away at the top and the streaks down the inside, which generally terminate at the water level of the gage glass. Friction of the water of condensation carrying particles of iron, rust and dirt is the most plausible, but it does not account for the eating away of the outside of the tube at the top, where it projects above the rubber packing and into the chamber of the water gage head. This projection forms a small cistern around the top of the tube, which is a receptacle for the water of condensation on the inner surface of the gage head at a constant temperature and pressure due to the boiler pressure, and which is constantly filling and overflowing and running down the inside of the tube. There being no friction worth consideration in the little cistern around the top of the tube, the only tenable theory for so great a waste of glass at this point must be found in the soluble power of pure water at the temperature and pressure in the boiler, and that pressure is the potent influence in the process. In support of this last point, we may point to experience with low pressure heating apparatus, for gage glasses that have been in use for several years on low pressure boilers of less than five pounds pressure have been removed with scarcely a mark of corrosion.

The cracking of water gage glasses may be mainly attributed to the tension of the glass on the inside surface by faulty annealing, as this is shown by the fact that a slight scratch around on the inside surface at the proper place will produce a crack following the scratch. This is the method used for breaking the tubes to the proper length for use, while if the scratch is made on the outside of the tube, it does not crack at the scratch naturally, and if pressure or a light tap is used to start the crack, it will break just where not wanted. This very plainly shows that there is compression on the outside and tension on the inside surface of the tube.

This is also manifest in the care necessary in cleaning the tubes by wiping, as every engineer knows by teaching or experience of the final cracking or splitting of the tube when an iron rod or wire is used for pushing the wad through the tube. Unless the whole rod is wound with a strip of cloth to prevent scratching, the contact from a scale or particle of grit may make a scratch that cannot be seen by the eye, but will soon split the tube when exposed to changes of temperature in the water gage. In this way a very curious phenomenon has been observed in the cracking of tubes in a spiral line for the greater part of their length. The cause of this has been traced to the fact that the construction of the water gage heads sometimes produces a whirl in the steam inside of the glass when it is blown off at the bottom. Any scale or other hard substance from the inside surface of the top connecting pipe partakes of the whirling motion of the steam, and the centrifugal force presses the particles against the inside surface with a sufficient force to produce a spiral scratch not noticeable at the time, but soon starts a crack that, as has been observed, ran on a spiral more than once around the tube.

Another source of trouble by breakage is from unequal expansion between the glass and the ironwork, especially if the water gage heads are screwed directly into the shell of a vertical or locomotive boiler. The expansion and contraction of the boiler plate is about 40 per cent. greater than that of glass for even changes of temperature; but as the glass tube below the water line may be somewhat cooler than the boiler plate, the difference in expansion may be greater than here stated. This strain constantly changing from day to day or week to week, presuming that the rubber packings have become hard or vulcanized to the glass, as is often the case, the contact becoming closer and with a longer bearing, from the screwing of the stuffing boxes too tight at first, or following up the cap to stop leaks, makes an immovable connection between the glass and the gage head that finally throws the whole strain from expansion upon the tube, which, with the natural tension upon the inner surface, pulls the tube apart.

When water gages are placed on columns of cast iron free from contact with the boiler, except by their connecting pipes, and care is used in squeezing the rubber packing rings lightly or only just enough to prevent leakage, there is far less trouble from breakage. By this arrangement the cast iron column is kept slightly cooler by the slower circulation of the inclosed water, and the cast iron also having a slightly less expansion than wrought iron for given changes in temperature, makes this method of water gage connection much the most reliable for safety as well as the steadiest indication of the water level in the boiler.

Where water gages are connected to the cast iron front with pipe connections to the boiler, corrosion of the gage glass seems to be largely increased, as observed, and also from the fact of the increased flow of hot water and iron rust through the glass from condensation in the usually bare pipe from the boiler. This is relieved in a great measure by the use of the independent stand pipe, which should be required by purchasers of boilers of any style in use.

FLOATING GRAIN ELEVATOR.

WE illustrate herewith a grain elevator constructed by Messrs. S. S. Stott & Company, of the Laneside Foundry, Haslingden, near Manchester, a firm which has long been associated with this type of engineering. This elevator was made for Russia, the grain being taken from one barge and passed into one or either of several barges lying alongside each other. In both cases the apparatus is on the endless chain and bucket system, the series of elevators is the same, although in the latter instance the grain is deposited in a "boot," and conveyed thence to the barges; in the other it is again raised and discharged by conveyor and gravitation into a ship's hold. The trestle shown in the engraving usually runs on rails laid on a barge 12 ft. or so wide; hence the name, a floating elevator. The boiler for supplying steam to the engine driving the elevators and conveyors is placed on deck or between decks; but this is a matter of arrangement according to requirements.

The framing of the trestle consists of T and angle irons with cross and diagonal stays, and it is carried on 18 in. wheels running on rails. The system of conveyors will at once be appreciated from the engraving. The grain is elevated from the barge which is supposed to be moored to the left of the engraving, carried along a conveyor, and discharged through a shoot into a boot at the bottom of the trestle, is thence raised by another elevator discharging through a telescopic shoot into the hold of the vessel. The apparatus illustrated has an overhang of 20 ft. into the barge. The elevators are extended from the outer ends of a pair of derrick arms. The elevator for the apparatus to discharge 60 tons per hour has buckets 15 in. long; for the machine delivering 100 tons per hour they are 18 in. long. They are carried by double lines of detachable link chain, 9 in. to 12 in. apart. These chains are operated by sprocket wheels at either end; these rotate in gun metal-bearings secured to the sides of the elevator trunk or casing, built up of timber with steel bracing and angle irons. The tension on the chain is provided by a screw and nut fitted to the bottom bearings. For this purpose the bearings on either side are fitted into sliding frames 12 in. long, and through each there is a square-threaded screw for the purpose of making the chain taut. At the top of the screw there is bevel gear to connect the screws on either side, so that both will act simultaneously. Inside the trunk the chain guides are of timber faced with steel, which can easily be renewed. At the bottom there is a 2 in. steel grid to prevent the buckets being damaged.

The grain is delivered from this elevator through a small hopper into the conveyor leading to the boot in the bottom of the trestle. To insure a readier delivery, there is a guide or backing pulley just under the point where the elevator tips its load. The conveyor is 20 ft. long. This determines the amount of overhang of the elevator so far as the barge is concerned. The band conveyor is supported on two wrought iron derrick arms of channel sections, with trunnions on each end, so as to swivel at both ends. These are supported at the outer end by steel wire ropes passing

GRAIN ELEVATOR FOR RUSSIA.

over pulleys at the head of the trestle to a power-driven crab on the platform on the trestle. The trunnions enable the derrick arms and the barge elevator to be drawn up in a vertical position alongside the trestle when not in use. The inclination at which the conveyor between the derrick arms will work varies from 15 deg. in an upward direction to 30 deg. downward. The band conveyor consists of an endless band of cotton 21 in. wide, passing round pulleys at each end, and supported by intermediate steel rollers about 5 ft. pitch. Angle steel rollers are attached to the sides of the conveyor for giving the necessary curvature. The framing supporting the pulleys is of timber. When desirable, the grain is protected from the weather by means of tarpaulins carried on T-irons, which are shown in the engraving.

The grain flows from the conveyor into a shoot built up of timber lined with steel, thence into the boot of the fixed vertical elevator carried upon the trestle. This elevator does not differ materially from the one which is suspended on the derricks for use in the hold of the barges. In the case of the 100 ton apparatus, it is able to discharge to a height of 25 ft. above water level, and even then the conveyor into the ship's hold might be placed at a slight upward angle, although obviously this would only be resorted to under exceptional circumstances. It is very unusual to find a ship with her fixed bulwark more than 25 ft. above water level. The telescopic shoot, or conveyor, into the hold of the ship, as the case may be, is also arranged to swivel fore and aft; but this necessitates in the case of a belt conveyor somewhat elaborate gear. This swivel gear is fixed to the side of the trestle, and consists of a cast iron frame with bevel and spur gearing. The sprocket wheel for driving the belt first actuates a horizontal shaft which through bevel gearing and a vertical shaft finally rotates a second horizontal shaft. This latter by spur gearing actuates the end shaft carrying the traveling drum around which the

belt travels. Thus the two horizontal shafts need not be parallel, the vertical shaft transmitting motion from the first horizontal shaft to the conveyor. This conveyor is usually about 25 ft. long in both 60 and 100 ton apparatus. Sometimes, as we have said, there is substituted a telescopic shoot constructed of steel plates, and about 30 ft. long, opening out in 10 ft. lengths. This, of course, can only be used when the vessel is lower than the top of the trestle of the conveyor.

Two 60 ton machines are not infrequently mounted upon one barge, in which case the power plant consists of a horizontal multitubular boiler, 7 ft. 6 in. in diameter by 7 ft. long, furnishing steam to two small horizontal steam engines, each with two cylinders, 7 in. bore by 12 in. stroke, the actual power required for both machines not being more than 20 indicated horse. The 100 ton machine is driven by a horizontal steam engine with two cylinders 9 in. bore by 15 in. stroke, steam being supplied by a horizontal multitubular boiler, 7 ft. in diameter by 7 ft. 6 in. long. The actual power required for driving a 100 ton machine is not more than 15 indicated horse. The engine drives a shaft with bearings on the deck of the barge, and extending the whole length of the railway on which the trestle is traversed. Power is transmitted from this shaft by wheels and detachable chain to a second shaft, fixed as shown on the traveling trestle. Similar chain gearing drives the shaft on the derrick arms, whence power is derived for the swiveling of the derricks, for driving the conveyor and the bucket chains of the elevator, as well as of the fixed elevator. Detachable chains are used in all cases, and where there are vertical drives tension wheels are introduced. For driving the fixed elevator power is taken from the same shaft to a shaft at the top of the trestle, which also drives the conveyor, extending over to the hatch of the ship. The sprocket wheels are all of steel. Inside the elevators the chain is of 2⅝ in. pitch in the case of the 60 ton apparatus and 3 in. in the 100 ton plant. The drive chain is 3 in. pitch, but the main drive from the engine shaft is 3½ in. pitch. The chains in the 60 ton elevator are constructed for a working strain of 850 lb., and in the 100 ton machine 1,500 lb.

On a platform of the trestle is a crab driven by two belts from the main shaft, so fitted as to give reversing motion, with one fast and two loose pulleys. All the wheels are of steel, the bearings of gun metal; sprocket gear is perferred, as it is unaffected by weather. All timber subject to the wearing action of the grain is steel-lined. The trestle wheels are driven by spur and pinion gear; the gage is usually 10 ft., and there are four wheels. The barges themselves are from 60 ft. to 100 ft. long, from 15 ft. to 20 ft. wide and about 10 ft. deep.

A special feature is that the apparatus is bolted to the deck, and that the grain is conveyed from one barge to another or on shore; and thus, instead of the band conveyor from the movable elevator, there is a steel telescopic shoot delivering into a hopper under which there passes a band conveyor which is led to the barge or on shore. The distance the grain may thus be conveyed is not limited, as several belt conveyors can be laid one under the end of the other. The order carried out by Messrs. Stott in this case was for conveyors to traverse 95 ft. from the foot of the elevator.—Engineering.

PHOSPHOR BRONZE.*

By Max H. Wickhorst.

Bronze is an alloy of copper and tin. Phosphor bronze is bronze containing varying amounts of phosphorus, from a few hundredths of 1 per cent. to 1 or 2 per cent. Bronze containing simply copper and tin is very liable to be defective from the presence of oxygen, sulphur, or occluded gases. Oxygen causes the metal to be spongy and weak. Sulphur and occluded gases cause porosity. Oxygen gets into the metal by absorption from the air. It can be eliminated by adding to the metal something which combines with the oxygen and then fluxes off. Such deoxidizers are zinc, antimony, aluminum, manganese, silicon, and phosphorus. Sulphur and occluded gases can be eliminated by melting the metal, exposing it to the air and letting it thus absorb some oxygen, which then burns the sulphur and gas. The oxygen can then be removed by adding one of the above-mentioned deoxidizers. The important use of phosphorus in bronze is therefore to remove oxygen and also indirectly to destroy occluded gas and sulphur.

At the C., B. and Q. R.R. brass foundry, at Aurora, Ill., we make a bronze with an extra high percentage of phosphorus, namely, 6 per cent. We make this alloy so as to have phosphorus in convenient form for use; and the process of manufacture followed by us is as follows: 90 lb. of copper are melted under charcoal in a No. 70 crucible, which holds about 200 lb. of metal when full; 11 lb. of tin are added and the metal is allowed to become hot. The crucible is then removed from the furnace and 7 lb. of phosphorus are introduced in the following manner: A three-gallon stone jar, half full of dilute solution of blue vitriol, is weighed. Then the weights are increased 7 lb., and phosphorus in sticks about 4 in. long is added till the scales balance again. The phosphorus is left in this solution half an hour or longer, the phosphorus being given a coating of copper, so that it may be dried and exposed to the air without igniting. We have ready a pan about 30 in. square and 6 in. deep, containing about 2 in. of water. Over the water is a wire netting, which is laid loose on ledges or supports along the inner sides of the pan. On the netting is blotting paper, and on this the phosphorus is laid to dry when taken out of the blue vitriol solution. The pan also has a lid which can be put down in case of ignition of the phosphorus.

We now have the phosphorus ready for introduction into the metal. This is done by means of a cup-shaped instrument called a retort or phosphorizer. One man holds the retort on the rim of the crucible in a horizontal position. A second man takes about three pieces of phosphorus and throws them into the retort. The first man then immediately plunges the mouth of the retort below the surface of the metal before the phosphorus has a chance to fall or flow out. Of course the phosphorus immediately melts and also begins to volatilize. As the phosphorus comes in contact with the metal, it combines with it. This process is continued till all the 7 lb. of phosphorus has been put into the metal. The metal is then poured into slabs about 3 in. by 4 in. by 1 in. thick. The metal is so hard that a greater thickness would make it difficult to break it up. When finished, the metal contains, by analysis, 6 per cent. of phosphorus. When we wish ordinarily to add phosphorus to metal, we do it by adding a little of this hardener.

Copper is a soft, ductile metal, with its melting point at about 2,000 degrees Fah., or 1,100 degrees Cen. Molten copper has the marked property of absorbing various gases. It is for this reason that it is so difficult to make sound castings of clear copper. Molten copper combines readily with the oxygen of the air, forming oxide of copper, which dissolves in the copper and mixes homogeneously with it.

A casting made from such metal would be very spongy. The bad effect of oxygen is intended to be overcome by adding zinc to the extent of 1 per cent. or more. This result can be much more effectively attained by the use of aluminum, manganese or phosphorus. The action of these substances is to combine with the oxygen, and as the product formed separates and goes to the surface, the metal is left in a sound condition. Aluminum and manganese deoxidize copper and bronze very effectively, and the oxide formed goes to the surface as a scum. When a casting is made from such metal, the oxide or scum, instead of freeing itself from the casting perfectly, generally remains in the top part of the casting mixed with the metal, as a fractured surface will show. Phosphorus deoxidizes copper, and the oxide formed leaves the metal in the form of a gas, so that a casting made from such metal shows a clean fracture throughout, although the metal is not as dense as when aluminum or manganese is used.

Copper also has the property of absorbing or occluding carbon monoxide. But the carbonic oxide thus absorbed is in a different condition from the oxygen absorbed. When oxygen is absorbed by copper, the oxygen combines chemically with the copper and loses its own identity as a gas. But when coal gas is absorbed by the copper, it keeps its own physical identity and simply exists in the copper in a state of solution. All natural waters, such as lake water, river water, spring water, etc., contain air in solution or occlusion. When such water is cooled and frozen, just at the time of changing from the liquid to the solid state, the dissolved gas separates and forms air bubbles, which remain entangled in the ice. The carbonic oxide which is dissolved or occluded in copper acts in exactly the same way.

Hydrogen acts in exactly the same manner as carbonic oxide. Sulphur also has a bad effect on copper and bronze. Sulphur combines with copper and other metals, forming sulphide of copper, etc. When molten copper or bronze containing sulphur comes in contact with air it absorbs some oxygen, and this in turn combines with the sulphur present, forming sulphur dioxide, which is a gas which remains occluded in the metal.

Tin is a soft white metal, melting at 440 degrees Fah., or 230 degrees Cen. Toward gases it acts something like copper, but not in so marked a degree. Although copper and tin are both soft, yet when mixed they make a harder metal. When bronze cools from the molten state, the copper and the copper tin alloy tend to crystallize by themselves. The quicker the cooling occurs the less separation will there be, and also the fracture will be more homogeneous in appearance.

Gun bronze contains copper and tin in the proportion of 9 or 10 parts of copper to 1 of tin. This is the metal used where an ordinary bronze casting is wanted. A harder bronze is copper and tin in the ratio of 6 to 1. This is often used as a bearing metal. When either of these metals is to be turned in the machine shop, they should contain about 3 per cent. of lead, which will make them work very much better, but it also decreases their tensile strength. Bearing metal now generally contains about 10 per cent. of lead, with copper and tin in varying ratios. The large percentage of lead is put in that the metal may wear away slower. Lead, although a metal having properties similar to tin, acts entirely different toward copper. Copper and tin have a good deal of affinity for each other, but copper and lead show no attraction at all for each other. Copper and tin mix in all proportions, but copper and lead mix only to a very limited extent. About 3 per cent. of lead can be mixed with copper. With bronze about 15 per cent. to 20 per cent. of lead can be mixed. In bearing bronze the lead keeps its own physical properties, so that the constituent lead melts long before the metal attains a red heat. It sometimes happens when a bearing runs warm that the lead actually sweats out and forms pimples on the metal. Or sometimes in re-melting a bearing bronze casting the lead may be seen to drop out while the metal is warming up. All of these metals, however, should contain something to flux or deoxidize them, such as zinc, manganese, aluminum, silicon, antimony or phosphorus.

The phosphor bronze bearing metal in vogue at Aurora has the following composition: Copper, 79·7 per cent.; tin, 10 per cent.; lead, 10 per cent.; and phosphorus, 0·3 per cent.

Melt 140 lb. of copper in a No. 70 pot, covering with charcoal. When copper is all melted, add 17½ lb. of tin to 17½ lb. of lead, and allow the metal to become sufficiently warm, but not any hotter than is needed. Then add 10 lb. of "hardener" (made as previously described) and stir well. Remove from furnace, skim off the charcoal, cool the metal with gates to as low a temperature as is consistent with getting a good casting, stir well again, and pour. The moulds for this kind of work are faced with plumbago.

There are several firms that make phosphor bronze bearings with a composition similar to the above one, and most of them, or perhaps all, make it by melting the metals and then charging with phosphorus to the extent of 0·7 to 1·0 per cent. But I have found some metal from all brands that I have tried that contains occluded gas. So that after such metal is cast, in about two minutes or so, the metal will ooze or sweat out through the gate, and such a casting will be found to be porous. But I have not yet had one such experience with metal made as I have described above. My explanation for the imperfections of metal made by adding phosphorus direct to the final mixture containing occluded gas would be this: The phosphorus as it is charged into the metal still contains a little moisture, and at the high temperature of the molten metal the phosphorus takes the oxygen from this water, leaving the hydrogen to be absorbed by the metal.

But this practical point should be heeded, viz., that pig phosphor bronze should be brought to the specifications that the metal should have shrunk in the ingot mould in cooling, as shown by the concave surface of the upper side, and that it should make a casting in a sand mould without rising in the gate after being poured.

In bearing metal, occluded gas is very objectionable, because the gas, in trying to free itself, shoves the very hard copper tin compound (which has a low melting point and remains liquid after the copper has begun to set) into spots, and thus causes hard spots in the metal.

Phosphorus is very dangerous to handle, and there is great risk from fire with it, so that many would not care to handle the phosphorus itself. But phosphor copper containing 5 per cent. of phosphorus, and phosphor tin containing 2 to 7 per cent. of phosphorus, and several other such alloys can be obtained in the market. I would suggest to those who wish to make phosphor bronze, but do not want to handle phosphorus itself, to make it by using the proper amount of one of these high phosphorus alloys. In using phosphorus it is only necessary to use enough to thoroughly deoxidize the metal, say 0·3 per cent. More than this will make the metal harder, but not any sounder.

In the course of the discussion Mr. Wickhorst stated that phosphor bronze shrinks very little. He expressed the belief that the pure copper castings used in electrical work are made with the aid of silicon copper.

* A paper read before the Western Foundrymen's Association, Chicago, March 17, 1897.

THE FIRST ENGLISH ARMOR PLATE ROLLING.

In a sketch of the life work of Sir John Brown, the eminent English iron and steel manufacturer, The Engineer gives the following account of the first armor plate rolling in England:

"It is Mr. Brown's custom to go on the Continent every autumn. In 1860, on his way home, he returned by Toulon. There was no little commotion in the place that day. The French ship La Gloire had put into the harbor. This ship was a wooden 90 gun three decker. The French had cut her down into a sort of magnified corvette, armed her with forty heavy guns, and clothed her with hammered iron armor 4½ inches thick; the plates were each five feet long and two feet wide. This 'new departure' in men-of-war put our admiralty in a fever. Ten 90 gun and 100 gun timber built ships were at once stopped in their construction, the intention being to make them so many British editions of the French craft. Sir John tried to get on board the ship. He was not allowed. Inspecting the vessel very closely through his glasses, his quick eye detected that the hammered armor had a cobbled look, rough, like a rubble wall. He felt sure he could do better than that. Convinced that he could roll a plate superior to anything that could be hammered, he went back to Sheffield and set to work. He put down a rolling mill, and experimented incessantly until he achieved his purpose. At a meeting of the Institution of Mechanical Engineers, Sir John read a paper, in which he gave a description of the method of rolling a five ton armor plate. As the first authoritative account of armor plate rolling in England, an extract is worth preserving. Here it is: Several bars of iron were rolled twelve inches broad by one inch thick and were cut thirty inches long. Five of these bars were piled and rolled down to another slab, and these two slabs were then welded and rolled down to a plate 1¼ inches thick, which was sheared to four feet square. Four plates like that one were then piled and rolled down to one plate, measuring eight by four feet and two inches thick. Lastly, four of these were piled and rolled to form the final and entire plate. There were thus welded together sixteen thicknesses of plate, each of which was originally one inch thick, to form one plate 4½ inches thick, being a reduction of thirty five times in thickness, and in the operation from 3500 to 4000 square feet of surface had to be perfectly welded by the process of rolling. Even with the greatest care it was not surprising that blisters and imperfect welding should occur and render the plate defective. This was the chief difficulty to be overcome, and it increased with the magnitude and weight of the plate, the final operation of welding the four plates, measuring eight by four feet and 2½ inches thick, being a very critical one. The intensity of the heat thrown off was almost unendurable, and the loss of a few moments in the conveyance of the pile from the furnace to the rolls would be fatal to success."

The Chicago Trade Bulletin says: "From present indications the United States will raise the largest yield of wheat in many years, and probably the finest crop harvested by any country in 1897. The yield, while liberal, will probably fall below the quantity reported in 1891, but the outlook now favors the second largest yield ever reported. The winter wheat crop is virtually out of danger, and the spring wheat crop, with a backward and unfavorable start, owing to unseasonable weather, is now reaching maturity in good condition, though it will not be out of danger of the changeable weather of the Northwest for four or five weeks. It is virtually safe, unless some damage should occur, to calculate that the aggregate yield will approximate about 550,000,000, bushels, about 310,000,000 bushels of winter and 240,000,000 bushels of spring. At the same time, it is doubtful if the Department of Agriculture will reach such conclusions. The grain trade is confident that the area reported by the Department of Agriculture is too small, possibly by 2,000,000 acres, and this is the weak feature in the returns to the department. The deficiency is largely in the new sections of the country which have been opened up through the agencies of railroads and the land disposed of to emigrants. These people, as a rule, are indifferent about making reports, and have a dread of a crop reporter, regarding him as an agent of the assessor in disguise."

ENGINEERING NOTES.

In some of the American car shops the journals for car axles are now turned up by means of a tool extending the whole length of the journal and accurately ground to the proper shape. The cut is thus several inches wide.

It is interesting to note that the capital value of the British Navy at the present time exceeds 94,000,000 pounds. The first cost of the fleet which led to the downfall of Napoleon was but 10 millions sterling. The fleet then comprised between 480 and 490 fighting vessels.

There are now in operation in the United Kingdom 380 blast furnaces, as compared with 372 at the beginning of the year, says Engineering. Of the total 95 are in the northeast of England, 179 more in other parts of England, 81 in Scotland, and 25 in Wales. There are, however, 682 furnaces actually built, so that 302 are not in blast. At the beginning of the year there were 313 idle. Five new furnaces are being built and five are being rebuilt.

Some interesting data have been collected by Mr. F. P. Sheldon, of Providence, R. I., intended to show the actual cost of steam power in New England and New York cotton mills. The results are based on actual yearly accounts, not on tests or calculations, and the cost per horse power per year of 307 days, of ten hours each, is found to be less than the common estimation. Compound condensing engines were used, and the highest running expenses—that is, fuel, labor, supplies, and repairs, also including fixed charges—show a total yearly cost per horse power of $14.86, and the lowest running expenses and fixed charges $11.64. In the highest cases given, fuel cost is stated as amounting to $3 a gross ton; in the lowest, mixed dust and slack costing $1.76 a gross ton was burned.

Mr. Thomas Fletcher, says Engineering, has recently published an estimate of the amount of coal gas needed to maintain an ordinary small fire clay muffle at the proper temperature for various purposes, and using the gas in atmospheric burners. For hardening steel cutters, etc., which requires clear red heat, about 8 cu. ft. of gas per hour are needed for every 10 sq. in. of floor area of the muffle. A yellow such as needed in silver assay work requires a consumption of 10 cu. ft. of gas per hour, while the bright yellow used in gold assays requires about 11 cu. ft. per hour. For still higher temperatures, such as needed in china, enamels, etc., the consumption may go up to 14 cu. ft. of gas per hour for every 10 sq. in. of the floor area of the muffle. Where metal muffles can be used, or the gas can be burned under pressure, a smaller consumption is needed.

The copper production of the world for 1896 is thus given in Le Génie Civil:

Country.	Metric tons.
United States	203,893
Spain and Portugal	53,375
Chile	23,500
Japan	21,000
Germany	20,065
Mexico	11,150
Australia	11,000
South Africa	7,450
Other countries	21,825
Totals	373,208

In 1888 the total copper production was 258,036 tons; in 1890 it was 310,472; 1893, 303,534; 1894, 324,505; and in 1895 it was 334,285 metric tons.

A model macadam road is being built at New Brunswick, N. J., by the road bureau of the United States Agricultural Department. Through the efforts of Prof. E. B. Voorhees, of the New Jersey Experimental Station, at New Brunswick, two government experts have been sent to supervise the construction and to bring with them the most approved machinery. The street treated is College Avenue, in the residential part of the city. The trap rock is crushed upon the ground, spread by an improved distributing wagon and laid to a depth of 4 inches. It is then rolled by a heavy steam roller and treated with a covering of cinders and a final coat of screenings. When this is completed, a 600 foot length of "farmers' cheap macadam" road is to be built. This road will be 8 feet wide and 5 inches deep. Road engineers and freeholders from various parts of New Jersey are closely watching the methods of construction.

Burning corn for fuel has often been mentioned by political orators as one of the signs that the poor farmer who burns it is in the last ditch of poverty, but a bulletin issued by the Experiment Station of the University of Nebraska, giving results of tests of the value of corn as fuel, shows that the burning of corn may be a proceeding showing financial wisdom and one greatly to the farmer's benefit when the price of corn is low and that of coal high. The tests showed that 1 lb. of screened Wyoming coal, costing $6.65 per ton, evaporated 1·9 times as much water in a steam boiler as could be evaporated by 1 lb. of a good grade of yellow dent corn on the ear, not thoroughly dry. The following figures show the value of corn per bushel as fuel when coal of the same variety as that used in the tests is selling at the prices given:

Coal per ton	$4 87	$5 41	$5 95	$6.19	$7 11	$7.57	$8.11
Corn per bushel	9	10	11	12	13	14	15

The calorific value of bagasse has recently been determined at the Ohio State University, and we are indebted, says the Engineering News, to Prof. W. T. Magruder, professor of mechanical engineering in that institution, for the following results of tests. Bagasse is the ground sugar cane, which is used by the sugar mills as fuel under steam boilers. The samples came from the Glenwild Sugar Factory, Berwick, La., and the tests were made with the Mahler calorimeter by Mr. Frank Haas, of the chemical department of the university. The moisture found in two samples, after drying to constant weight, was 44·13 and 44·38 per cent., average 44·26 per cent. The heating value of the dry bagasse, in three tests, was 4,542, 4,541 and 4,476 calories, or an average of 4,520 calories per lb., or 8,136 British thermal units per lb. This is equivalent to 4,535 B. T. U. for the moist **bagasse containing 44·26 per cent. moisture.**

ELECTRICAL NOTES.

Three interesting papers on transmission of power were recently read before the British Institution of Civil Engineers. Preece states that if coal costs only $1.25 per ton for transportation 100 miles, this is less than the interest on the capital required for construction of plant to transmit electrically, but other advantages of electric transmission are pointed out. Ellington writes on hydraulic transmission, and claims an efficiency of 75 per cent. over an area of 4 square miles, served from one pumping station, admitting, however, that this efficiency may drop to 50 per cent., depending on the application of the power. The third paper, by Hopkinson, refers to five methods of power transmission. He decides on compressed air as best for tunnel work, but recognizes the advantages of electricity in its flexibility. He also gives a prominent place to hydraulic transmission.

A new design of multiphase generator has been recently developed by the engineers of the General Electric Company, says the Engineering News, which is notable for the simplicity of its construction. This dynamo is a three-phase alternator with rotating fields and stationary armature, a design which so greatly facilitates the security of high insulation upon the armature that the dynamo can generate currents with pressures up to 5,000 volts. The machine is thus admirably adapted for long distance power transmission, as it dispenses with the necessity for step-up transformers in the power station. The rotating field has a substantial spider supporting a soft steel yoke ring magnetized by removable coils constructed to permit free ventilation. Current at low voltage is supplied to this field by two collector rings mounted upon the shaft. The armature coils are wound on forms and afterward placed about the poles, and thus a large portion of the coils remain exposed for ventilation. While these alternators have excellent inherent or self-regulating properties, they are sometimes compounded to insure accurate automatic regulation. Large generators of this type will be installed in the great Lachine Rapids plant, in the new Brooklyn Edison station, and in London, for the Central London Underground Railway.

Recent occurrences in Europe have brought out very clearly the growing use of electricity in warfare, says the Electrical Engineer. Naval experts at Kiel have been testing the practical uses of dragon-shaped airships or balloons, which may be put on board vessels for use during naval engagements and in reconnoitering. Some of the balloons rose 5,500 ft., remaining fastened to the decks of torpedo boats, which were steaming 18 knots an hour, enabling the balloonists to make valuable observations of the stations of vessels at a great distance. The observations made were communicated by telegraph or telephone from the balloons to persons on the decks of the vessels below, enabling them to change the course of the latter accordingly. At the British jubilee naval review the United States man-of-war Brooklyn received great attention; and Mr. Laird Clowes, the naval expert, declared that, as proved by the new ship, England is in the resort to electricity many years behind the United States. That she will remain so is seriously open to question, but credit for our leadership is welcome and must be ascribed to the patient and brilliant work of such men as Lieut. B. A. Fiske, who may be said to be devoting their lives to this subject, in behalf of our navy.

The Electrical Review does not regard vestibuled trolley cars with favor, and urges some practical objections to their employment. Commenting on the law passed by our last Legislature making it obligatory on all surface railroad corporations operating street cars in cities of less than 50,000 to run vestibule cars in the inclement winter months, it says: "If we are to judge by results elsewhere, the wisdom of such a law is doubtful, and its operation a useless expense to the railway companies. The glass front of the vestibule is the objection, for two reasons: It gets covered with frost, rain or snow or moisture, and becomes a serious obstruction to clear vision on the part of the motorman. It acts at night, besides, as a mirror, reflecting back the light thrown out from the car. So serious is this that in many cases the management has been compelled to hang a curtain across the car door so as to keep the vestibule dark, but it is a doubtful remedy. The general result of a vestibule law has been, we believe, to increase the number of accidents. If the law were amended to be something in line with the marine regulations compelling pilots to keep at least one window open to the air, most of the objectionable features would be eliminated and a higher degree of safety assured."

Long distance transmission has received quite a substantial impetus by the signing of a contract between the Southern California Power Company and the General Electric Company for an 80 mile electrical transmission equipment, says the Engineering News. This is really a remarkable step, and shows clearly that modern electrical machinery is reaching a very high degree of refinement. Previous to this the Ogden-Salt Lake City plant, in which power is transmitted a distance of 36 miles, held the record. The new California plant will be over three times as long, will transmit four times the power and will have a line pressure three times as great as the present Niagara Falls and Buffalo transmission plant. The power station will be located twelve miles from Redlands and will utilize the river running through the Santa Ana Canyon. The present plan is to draw water from this river at its junction with Bear Creek and convey it by means of suitable canals, tunnels and flumes along the canyon sides to a point where the riveted steel pipe line will begin. This will have a vertical fall of 750 ft. in its length of 2,200 ft. Four impact wheels will drive four General Electric three-phase generators, each of 750 kw. output, to which they will be directly connected. 250 kw. step-up transformers will raise the pressure to 33,000 volts. This unusually high line voltage is considered advisable owing to the very great length of the transmission. It will necessitate especial care in general insulation and line construction, but can be safely handled with present apparatus. Prof. E. M. Boggs, of the Arizona University, has been engaged as chief engineer for the Power Company.

SELECTED FORMULÆ.

Ink Eraser.—The following formulæ will be found effective and uninjurious to the paper if carefully handled:

Citric acid	1	part.
Water, distilled	10	"
Concentrated solution of borax	2	"

Dissolve the citric acid in the water and add the borax. Apply with a delicate camel's hair pencil, removing any excess of water with a blotter. A mixture of oxalic, citric and tartaric acids in equal parts, dissolved in just enough water to give a clean solution, acts energetically on most inks.—Canadian Druggist.

Dressing for Linoleum.—A weak solution of beeswax in spirits of turpentine has been recommended for brightening the appearance of linoleum. Here are some other formulas:

(1.) Palm oil	1	ounce.
Paraffin	18	"
Kerosene	4	"

Melt the paraffin and oil, remove from the fire and incorporate the kerosene.

Polish.

(2.) Yellow wax	1	ounce.
Carnauba wax	2	"
Oil turpentine	10	"
Benzine	10	"

Melt the waxes carefully, add the oil and benzine, and stir until cold.

(3.) Yellow wax	5	ounces.
Oil turpentine	11	"
Amber varnish	5	"

Melt the wax, add the oil, and then the varnish. Apply with a rag.—Pharmaceutical Era.

Perspirol.—For excessive perspiration of hands and feet:

Prepared Venetian talc	20	ounces.
Powdered orris root	10	"
Oxide of zinc	5	"
Powdered tartaric acid	5	"
Powdered boric acid	5	"
Salicylic acid	2½	"
Menthol	¼	"
Oil of eucalyptus	¼	"

Make a fine powder, to be applied to the hands and feet, or to be sprinkled inside the gloves or stockings.—Chemist and Druggist.

Compound Menthol Cones.—The following formula is given by Schimmel as representing a form of compound menthol cone which now finds widespread use:

Menthol, crystallized	1	part.
Chloral hydrate	1	"
Cacao butter	2	"
Spermaceti	4	"

The best way to prepare the cones is to melt the spermaceti and the cacao butter; dissolve the other ingredients in the melted mixture, and then pour the whole into chilled moulds.

Starch Glaze (Powder).—

Gum arabic, powdered	3	parts.
Spermaceti wax	6	"
Borax, powdered	4	"
White corn starch	8	"

Method of Preparation.—All these bodies are to be intimately mixed in the powder form by sifting through a sieve several times. As the wax is in a solid form and does not readily become reduced to powder by pounding in a mortar, the best method of reducing it to such a condition is to put the wax into a bottle with some sulphuric or rectified ether and then allow the fluid to evaporate. After it has dissolved the wax, as the evaporation proceeds, the wax will be deposited again in the solid form, but in fine thin flakes, which will easily break down to a powder form when rubbed up with the other ingredients in a cold mortar. Pack in paper or in cardboard boxes. To use, four teaspoonfuls per pound of dry starch is to be added to all dry starch, and then the starch made in the usual way as boiled starch.—Canadian Druggist.

Photographic Hints and Formulas.—

From Liesegang's Photographischer Almanach.—(Amer. Photo Jl.)

Dr. Andresen's Eikonogen Formulas.—

(1) One solution:

Sulphite of soda (crystals)	4	parts.
Carbonate of potash	2	"
Eikonogen	1	"
Distilled boiling water	40	"

This mixture, while still warm, should be put into bottles, which must be well corked. It will then keep in good condition for an indefinite time, provided pure boiling water and a good quality of sulphite of soda have been used. Should the developer prove too strong, it may be diluted with a sufficient quantity of water; for the production of especially delicate negatives the quantity of carbonate of potash should be reduced by one-half. In case of over-exposure, start developing with a fresh weak solution, to which a few drops of a solution of bromide of potassium have been added; or better still, develop with a solution that has already been used. To develop bromide prints, the developer should be diluted with five parts of water.

(2) Separate Solutions:

(a) Sulphite of soda (crystals)	4	parts.
Water	60	"

To this add one part of eikonogen, and shake till dissolved.

(b) Carbonate of soda (crystals)	3	parts.
Water	20	"

For use, mix three parts of (a) with one part of (b).

Fixing Bath.—Plates which have been developed with eikonogen should be well washed, and can be advantageously fixed in an acidulated fixing bath. To obtain this, dissolve one part of fixing salt in eight parts of water or dissolve five parts of sulphite of soda (crystals) in one hundred parts of water, acidulate with one part of concentrated sulphuric acid, and then add twenty parts of hyposulphite of soda. The bath remains clear even after frequent usage, it hardens the gelatine, and yields negatives of a very fine printing color.

ELECTRICALLY DRIVEN PLOWING TACKLE.

From time to time during the last ten years and more we have heard rumors of steam and horses being supplanted in plowing by electricity, but the affairs have usually been only experimental and have led to no permanent results. Lately, however, the system has been worked out in Germany on a commercial basis, and we are now able to lay before our readers illustrations of machines constructed by Mr. A. Borsig, of Berlin, and now being used in many localities. Electric plowing tackle is best adapted to meet the requirement of the great beetroot estates in Germany, which are devoted to the manufacture of sugar, for they are of large extent, and have command of capital to enable them to adopt all labor saving appliances. Further, there are, on such estates, large installations of steam power, which lie idle a great part of the year, including the period at which plowing is done. Hence, by the addition of dynamos, and of a system of overhead conductors in the fields, it is possible, at small cost, to adopt electric plowing over a large area.

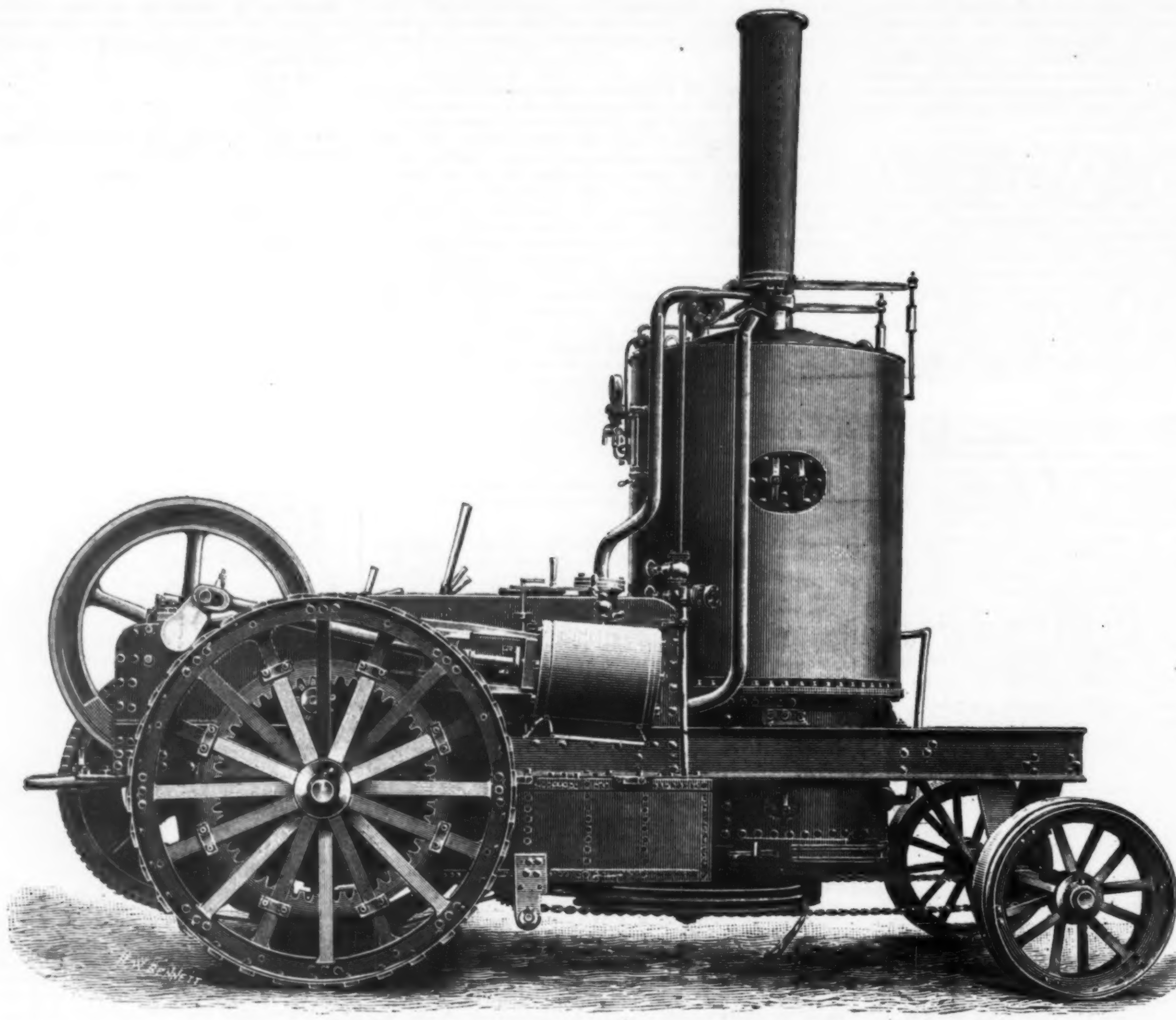
The overhead conductors do not extend into all the fields, but are tapped by temporary wires laid on the ground, as required.

In cases in which electric power is not available, Mr. Borsig plows by steam, employing an engine of the form shown in the engraving. It will be seen that it is fitted with a vertical boiler, the firebox of which is furnished with a number of diagonal tubes to increase the heating surface. The boiler barrel can be removed bodily when it is desired to scale the firebox. The engine is self-propelling, and can be used to haul the other appliances to and from the fields. Its arrangement of rope drums is similar to that of the motor wagon we are about to describe.

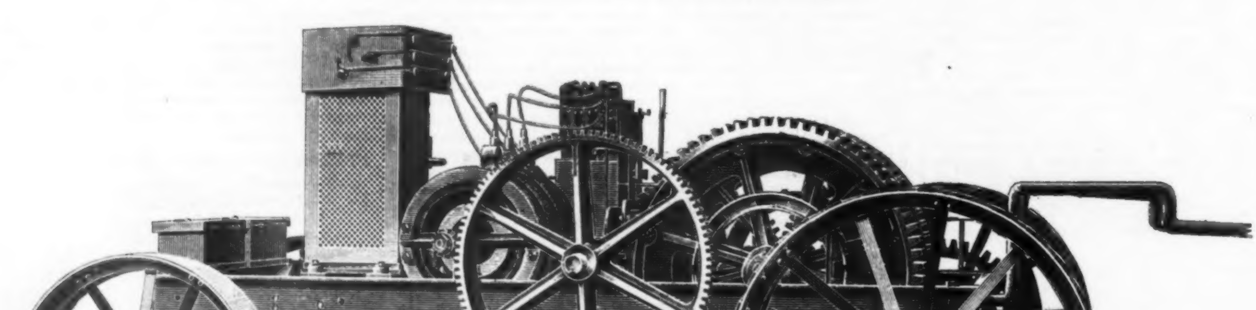
The motor wagon carries two drums on horizontal axes. On these the two ends of the rope are wound, the bight passing round the sheave on the anchor wagon. One drum is driven to draw in the rope, while the other runs under a brake, to keep the tail rope fairly taut. The two parts of the rope are led round guiding sheaves, revolving in horizontal planes, under the wagon. The two rear wheels can be connected to the motor by clutches and gearing to propel the wagon, while the two leading wheels serve to steer it. On the opposite side of the wagon to that shown in the view there is a platform for the attendant, with the various handles and levers grouped in front of it. The weight of a motor wagon is 7 tons.

Mr. Borsig states that with fixed steam engines of 250 horse power, and with five plows, 6000 acres of medium heavy ground can be plowed to a depth of 14 in. at a cost of 3s. 10d. per acre. If separate engines have to be employed, the cost per acre is increased by 7d. per acre.

The anchor wagon shown in the other cuts carries a sheave round which the plowing rope runs. The sheave is fixed in a guide, and is connected by a chain to the anchor. Hence as the anchor sinks into the earth under the pull of the rope, the sheave and it move together. The anchor itself has four prongs, and is hung from a light crane, or derrick, by which it can be completely raised for traveling, if the jib be wound up by the worm hoist at the opposite side of the frame. At other times it is manipulated by the chains running round the pulleys at the head of the jib. The slack end of the plowing rope, when the plow is moving toward the motor wagon, actuates gearing which winds the anchor out of the ground and moves the anchor wagon forward into the right position for the next double set of furrows. At the same time the anchor and sheave are moved backward relatively to the frame to allow for the slip of the anchor in the earth. The anchor is then dropped by the attendant and the next set of furrows cut. The strain of the rope goes direct from the pulley to the anchor, and not through the wagon frame. We are indebted to London Engineering for the cuts and description.



STEAM TRACTION ENGINE FOR PLOWING.



ELECTRICALLY DRIVEN MOTOR FOR AGRICULTURAL USE.

BLEACHING WAX AND STEARINE.

By S. Rambor.

In bleaching beeswax it is usual to expose the crude material in the form of rather thin, round cakes to the action of the sun, and this way the wax does not lose or hardly lose any of the specific aroma which is one of its much sought for qualities. (Chem. Zeit.) As to the consistency and hardness of wax thus bleached, it is equal to that of the raw material. Unhappily, this process has several faults. The chief of these is the long time which the operation takes, and this is a matter which affects the economy of the process to a large extent. Attempts have been made to abridge the time exacted by bleaching operations, but, unhappily, results have not responded to the hopes of the inventors of the methods proposed.

The process which has furnished so far the best results is that which consists in augmenting artificially the richness of the air in ozone. Practice shows us, in fact, that the bleaching rooms for wax situated in the country in the proximity of pine forests operate with much more efficacy than those which are by their situation placed in atmosphere less saturated with ozone. The artificial distribution of ozone is done by finely spraying spirits of turpentine or just lately by galvanic measures. Unfortunately, an effective abbreviation of the period of bleaching is only obtained in this manner when the wax has been melted to begin with in the presence of a certain quality of humidity. If this condition is not filled, the ozone produced, whatever may be the quality of it, has no action on the wax. The production of the ozone by turpentine is alway perfect, for the simple reason that the peculiar aroma of the wax is better preserved in this way.

But although the period of bleaching seems to be sensibly shortened by the aid of ozone, nevertheless entire weeks are needed, and if the weather is unfavorable even entire months, to bleach the wax in satisfactory fashion. A number of processes of bleaching by the aid of drugs have been tried and practiced industrially with the object of arriving more rapidly at the end proposed, but unhappily none of them is capable of destroying the coloring matter alone without harming some of the other properties of the material. At the same time that color disappears the chemical products employed destroy the special aroma of the wax, which, of course, is very similar to that of honey. Moreover, methods of energetic oxidation have influence on the consistency of the wax, which they render brittle. Therefore, although bleaching by chemical means hardly needs more than twenty-four hours, and gives an absolutely white product, the process has not been generalized. In the few factories where it is adopted, from 5 to 10 per cent. of matter naturally colored and aromatized is added to the bleached wax to recover as nearly as possible the tone and the perfume of the original product. Still the product thus treated changes color and loses its perfume at the end of a few days. The essence of wax prepared by Schimmel & Co. has also been tried, but the results have not given satisfaction. The product aromatized by its means loses its perfume rapidly, and ends by giving out a disagreeable odor of gasoline. It follows, therefore, from what we have said, that the only way of reaching the end proposed is to look for some method of modifying to the best advantage the natural process of bleaching. Having arrived at this conclusion, the author has undertaken a series of experiments on the best manner of carrying the natural method out, and has arrived at the following conclusions:

1. The Proportion of Water in Wax.—Wax entirely dry exacts double the length of time for its bleaching as that which contains from 2 to 5 per cent. of water. If, therefore, an energetic ventilation is arranged, by means of which it is possible to pass moist air over the cakes of wax, a slight humidity will help the operation very greatly, especially if the cakes are not too thick.

2. Saturation with Humid Air.—When the air is saturated by steam vapor, four times as much time is required to arrive at an identical result, even when the other conditions are most favorable.

3. Surface Exposed.—All other conditions being equal, the time of bleaching is in direct relation with the amount of surface exposed. It is, therefore, of the highest importance to expose to the action of the air and sun as much surface as possible.

4. Temperatures.—If the wax containing 3 per cent. of water and in slices as thin as possible is exposed in a refrigerator at a little under freezing point to the direct rays of the sun, no traces of bleaching are noticed for a long time. If, on the other hand, the wax is exposed to the direct sunlight at a temperature of about 75° F., bleaching takes place very rapidly (about 70° F. is sufficient for the commercial operation).

5. The Sun.—As we have seen in the preceding paragraph, the action of light is almost nil at low temperatures. According to the personal experience of the author, diffused daylight seems to have rather more energetic action than that of the direct rays of the sun, all other conditions of temperature, air, etc., being equal.

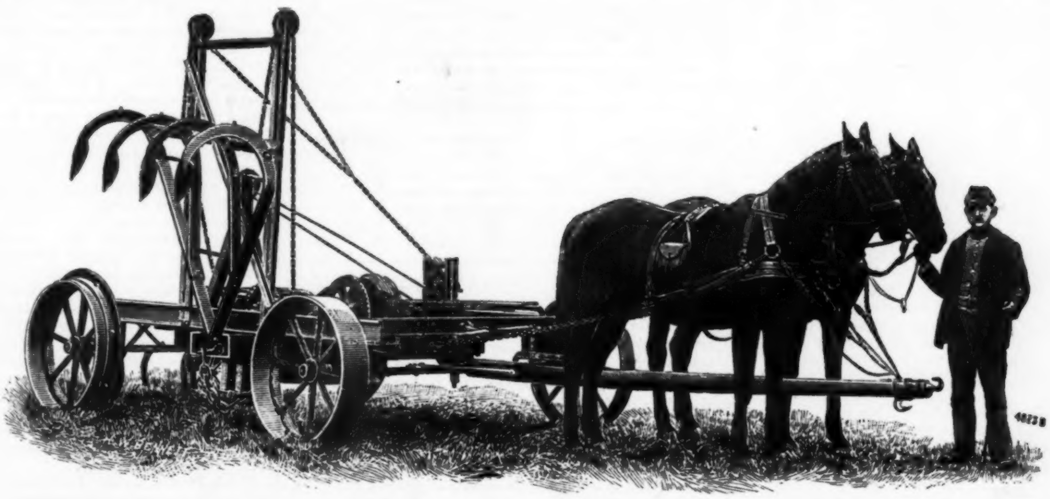
If we put these observations into practice, a white wax with the odor of honey will be obtained in a relatively short time. This aroma will not disappear after years of storing if the product is stocked in closed vessels and kept in an obscure place. In addition to the greater surface to be given to the matter to be bleached, great care should be taken not to work except in ventilated rooms provided with heating apparatus which can be regulated at will, so as to give the needed heat to the air in humid and cold weather.

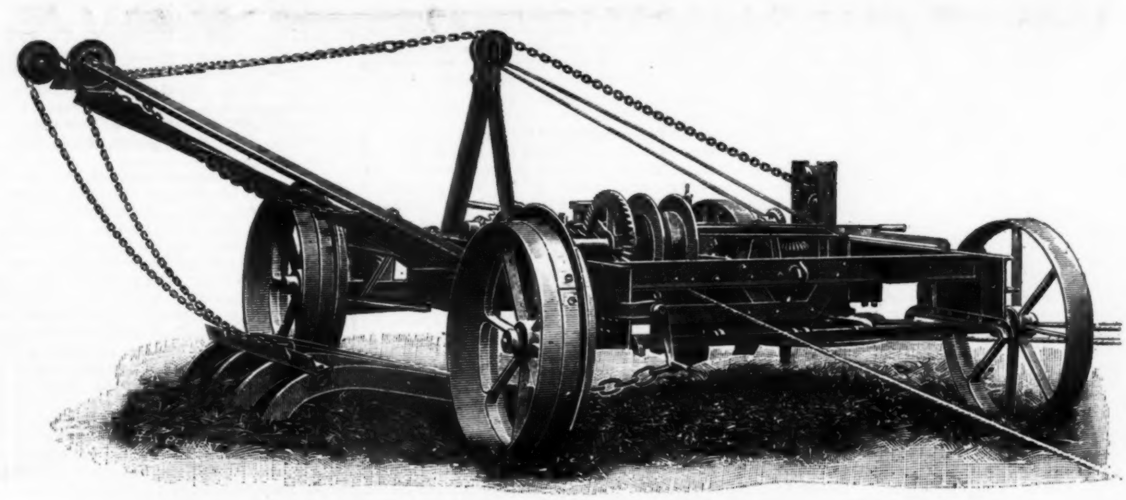
If the wax which has been bleached is melted with virgin wax, the bleaching of this latter seems to take place more rapidly; thus, for example, if two pounds of crude wax are melted with one pound of bleached material, only half the time will be needed to bleach this mixture that would be taken in bleaching three pounds of crude wax. We can say, therefore, that the bleached material bears in itself the power of bleaching, and this fact is in direct parallel with the other fact already noted, that a very considerable time is needed before the action of bleaching begins to show itself on the surface of the raw material, and that, on the other hand, as soon as the surface begins to show the bleach, the effect produced transmits itself very rapidly through the whole of the mass.

If the wax is melted and poured on thin plates of iron and exposed thus to the bleaching agents, this also contributes to accelerate the action of bleaching. A bleach of surprising rapidity is got with the Laval "Emulsor." If the virgin wax is melted and made into an emulsion with water at from 75° to 100° C., and if after stopping the emulsionizing apparatus the mass obtained is thrown into cold water, the result is to get a quantity of globules of wax of extreme tenuity, which in favorable weather are bleached at the end of two or three days. If the wax is melted, to begin with, with a third of its weight of wax already bleached, the operation does not take more than forty-eight hours. As the apparatus gives a considerable yield (220 gallons of emulsion per hour), the process may be considered as a very practicable one from a commercial point of view. With the aid of this apparatus, which is capable of giving the matter to be bleached a very extended surface, we believe that natural bleaching can enter into serious competition with the chemical bleaching, at least so far as the saving of time is concerned. And if, on the other hand, the fact that the natural properties of the wax are preserved by natural bleaching is taken into account, we do not doubt that this new process will be universally adopted. The high prices actually obtainable, and the more and more frequent adulterations of the product, will give an extraordinary value to a process which will leave the wax the natural and characteristic signs of purity.

With the same emulsionizing apparatus the chemical bleaching can be done in ten minutes as follows: The crude material is emulsionized in slightly alkaline water and brought up to 175° F., then after having been treated with hypochlorite of sodium and allowed to rest for ten minutes, hydrochloric acid is added until an acid reaction is obtained. The mass is then emulsionized anew in warm water to get rid of the acid which adheres to the particles, and a white wax is then obtained with very fine grain and free from ash. Its only fault is that it lacks aroma. The same satisfactory results are got with Japan and Carnauba waxes.

Finally, we may note that the fatty acids for stearine making, whether got by distillation or expression, behave like animal wax in the presence of bleaching agents, and it is also possible to accelerate the bleaching of these products in the same way. The well known and frequent difficulties of manufacture, when the candles remain for entire weeks without changing in the bleaching room, without a plausible reason for the phenomenon being apparent, arise without doubt from the insufficient state of hydration of the stearine, or from a too low temperature, or from the surrounding air giving off too much humidity. If, therefore, stearine already bleached is melted with crude stearine and emulsionized in lukewarm water, so that the mixture can be thrown into cold water with or without the addition of a little oil of turpentine, a very white and beautiful stearine will be obtained in a few days even under bad conditions of climate. The stearine becomes very hygrometric by emulsion. The fusion eliminates the water, and it is only a very small proportion that the stearine retains in purely mechanical mixture. From this moment the bleaching takes place very rapidly. The candles moulded out of the stearine dry thoroughly during the bleaching and burn in a normal manner.—Pharmaceutical Era.





THE ANCHOR WAGONS, SHOWING ANCHORS RAISED AND LOWERED.

ON CHICLE GUM.

By Edward N. Butt.

When at Campeche, in Southern Mexico, a few weeks ago, in addition to logwood, mahogany, hides and other miscellaneous cargo, we shipped from thirty to thirty-five tons of chicle gum. At Progreso, in Yucatan, our next port of call, another twenty-five tons of chicle gum was added to the cargo. From subsequent inquiries I found that the gum in question was produced by the Achras sapota, a tree which grows wild in the forests in the state of Yucatan and the immediately adjoining states of Central America. It is indigenous from Mexico to Guiana, and cultivated in all tropical countries.

In the states of Campeche and Yucatan the Peons, as the lower class of natives of Aztec descent are called, search the forests where these trees grow, and, having selected those which are sufficiently mature, make V-shaped incisions in the stem. The juice which exudes from the incision soon becomes indurated by exposure to the scorching heat of the sun and is subsequently collected. Fresh V-shaped incisions are made in the same trees from time to time for a period of two or three years and the indurated gum collected. The trees are then allowed to rest for four or five years, after which period they are again fit to undergo the tapping process and yield fresh supplies of gum. When a sufficient quantity of the crude gum has been collected it is pressed into thick oblong blocks, which weigh from twenty-five to thirty kilos each. The collector then usually carries the gum to the stores of the merchants, either suspended from his head or packed on burros, as the Mexicans call that patient animal the donkey. The exporting merchant usually packs three of these blocks in a bale, the average weight of each bale being eighty kilos. In the year 1895 no less than four million pounds weight of chicle gum, of the estimated value of one and a half million dollars gold, was imported into New York from Mexico. I inquired for what purposes this large quantity of gum was used, and found it was the basis or chief ingredient used in the manufacture of "chewing gum," a substance practically unknown in this country, but almost universally used in the United States by men, women and the young of both sexes, many of the male population having adopted it as a harmless substitute for tobacco. The habit of chewing "chewing gum" is said not only to increase the flow of saliva, but to relieve indigestion and dyspepsia. This may possibly be the case with those samples which contain pepsin, especially as the once prevalent habit of spitting is rapidly on the decline, partly due to the substitution of gum for tobacco for chewing purposes, but mainly in consequence of the affixing of notices in all the street cars of most of the cities in the Eastern States prohibiting spitting therein, signed "By order of the Board of Health."

When I had obtained the above information respecting chicle gum, I determined to make further inquiries and obtain as much information as I could about the manufacture of "chewing gum" during the short time I was in New York.

A quarter of a century ago there were practically only two kinds of "chewing gum" in use in the United State, viz., the regularly prepared spruce gum and shoemaker's wax. A little later a mixture of paraffin wax with either resin, balsam of tolu or some other ingredient of a similar character was put on the market. This new variety of chewing gum rapidly became a favorite with the ladies and also with the youngsters, who called it "Coal oil gum." Preparations called "Taffy tolu" and "Snapping wax" were next introduced for similar use. These preparations acted as the pioneers for the enormous trade which has sprung up in "chicle chewing gum." Its present use was discovered by an accident. Some twelve or fourteen years ago a lot of this Mexican gum was sent to New York on board ship partly as ballast and partly in the hope that it would be found suitable for use by bookbinders or possibly in the leather trade. After several trials it was found to be quite useless for any known purpose, and failing to find a purchaser, it was decided to tow it out to sea and throw it overboard in order to get rid of it. Just at that time one man out of the hundreds who were standing at the wharf casually picked up a piece of the gum, examined it and found it would "chew." The idea at once occurred to him that it would form a suitable basis for making a new kind of chewing gum, and without difficulty he succeeded in obtaining the whole lot for the trouble of shoveling it out of the ship. That man was a Mr. Adams, the head of the firm of Messrs. Adams, Sons & Company.

Mr. Adams' first venture in making chewing gum was cooked in a tea kettle and worked up on the kitchen table. Now, the gum as taken from the bales is first chopped into small pieces and then boiled in water. Wood, pieces of bark and all other impurities which are light separate from the gum, float on the surface and are skimmed off, while those which are heavy, such as dirt, stones, etc., fall to the bottom. When the gum is perfectly clean and all the foreign substances have been got rid of, it is removed to a mill where it is ground up, the mill making about three thousand five hundred revolutions a minute. The ground gum is then subjected to a continuous heat of 140° F. in drying rooms. When the gum is sufficiently dry, it is sent to the cooks, who put it into large steam jacketed pans and add to it pure white sugar, granulated pepsin, powdered kola or other desired ingredients. It is then turned and mixed by an ingenious double acting rotating paddle until it has assumed the consistency of bread dough. The "dough boys" then take it in hand and add to it the flavoring ingredients, such as oil of peppermint, oil of wintergreen, etc., and while still warm thoroughly work and knead it until it looks like gingerbread, finely powdered sugar being added from time to time during the kneading process to prevent its sticking. It is then allowed to cool and afterward passed through steel rollers until reduced to the proper thickness, when it is removed to the markers, steel-knived rollers which partly cut through the long sheets of gum. Next it is removed to the seasoning room, and finally broken up into pieces of suitable size on the lines left by the markers. The finished gum then goes to the wrapping room, where the nimble fingers of one hundred and fifty to two hundred young ladies wrap it in waxed paper, tinfoil and pretty wrappers, and thence to the packers, who pack it in jars or boxes ready for sale to the numerous dealers.

RECIPES FOR MAKING CHEWING GUM.

Should any one in this country be desirous of embarking in the manufacture of this article, I append a few formulæ which I have taken from Merck's Market Report, but the different varieties and various flavors now on the market may be numbered by hundreds. Those varieties, however, of which chicle gum is the basis, are those which are most in favor at the present time in the United States:

1. Balsam tolu	4	parts.
Benzoin	1	"
White wax	1	"
Paraffin	1	"
Powdered sugar	1	"

Melt together, mix well and roll into sticks of the usual dimensions.

2. Balsam tolu	4	parts.
Resin, white	10	"
Paraffin	3	"
Powdered sugar	Sufficient.	

Melt the balsam, resin and paraffin together, and, while still fluid, incorporate sufficient sugar to make a suitable mass. Roll out with powdered sugar and cut into pieces.

3. Balsam tolu	3	parts.
Powdered sugar	1	"
Oatmeal	3	"

Soften the gum on a water bath and mix the ingredients; then roll in powdered sugar and cut into sticks.

4. Venice turpentine	40	parts.
Common turpentine	30	"
Yellow wax	20	"
Balsam tolu	4	"
Balsam Peru	2	"

Melt together and add in fine powder—

Cinnamon	12	parts.
Chocolate	20	"
Red sandalwood	4	"
Sugar	2	"
Myrrh	2	"
Galangal	2	"
Ginger	2	"
Cardamom	1	"

Mix, and, when sufficiently cool, roll out into sticks or any other desirable form.

5. Gum chicle	3½	pounds.
Paraffin wax	1	"
Balsam tolu	2	ounces.
Balsam Peru	1	"

Dissolve the gum in as much hot water as it will take up, melt the paraffin and mix all together, then take—

Sugar	10	pounds.
Glucose	4	"
Water	3	pints.

Dissolve the sugar and glucose in the water, boil the solution up to the "crack" degree, pour the sirup upon an oil slab, turn into it sufficient of the above gum mixture to make it tough and plastic, incorporate the flavor (powdered cinnamon, chocolate, sandalwood, myrrh, ginger or cardamom), and when sufficiently cool roll into sheets or sticks.

As there is "so much money" in chewing gum, some one may be desirous of going into the trade, but before starting to manufacture he must make sure of a continuous supply of the raw material. At the present time the whole of the export trade in gum from Mexico is in the hands of a very few persons, and the importers and manufacturers in the United States are also very few in number, less than half a dozen, I believe, who not only hold contracts with the exporters, but also refuse to sell the raw material.—Pharmaceutical Journal.

WORLD'S TEXTILE PRODUCTION.

In Kuhlow's, published at Berlin, we find the following:

"The production of raw material for the manufacture of textile fabrics has increased very much during the past forty years.

"In 1850 the quantity of wool grown in Europe, the United States, La Plata, the Cape and Australia amounted to 806,000,000 pounds; in 1870 to 1,371,000,000 pounds; in 1880 to 1,577,000,000 pounds; and in 1895, according to the 'Annual Report of the President of Permanent Commission on Customs Valuation,' to 2,334,000,000 pounds, or nearly three times as much as that available for manufacture in 1850, 70 per cent. more than in 1870, and 45 per cent. more than in 1880.

"The increase in the quantity of cotton available for commerce, and which increase goes on from year to year, has also been marked. It is estimated that the amount yielded by the United States, India, Egypt and other countries was 636,000,000 pounds in 1830, 1,192,000,000 in 1840, 2,391,000,000 in 1860, and 4,039,000,000 in 1880. According to the report of the president of the valuation commission, the world's cotton crop in 1895 was 18,200,000 bales of 400 pounds, or about 7,280,000,000 pounds. This is eleven times more than in 1830, six times more than in 1840, three times more than in 1860, and 80 per cent. more than in 1880. The above mentioned report states 'the consumption cannot keep pace with the production,' but if the retail price should fall, many consumers would become large purchasers. The report adds that 'spinners never had such an opportunity of stocking at a low price, but that the year was less advantageous to the weavers than to the spinners.' Of the 18,200,000 bales produced in 1895, 10,500,000 bales (these of 450 pounds) were from the United States, 2,600,000 bales (of 400 pounds) from India, and 634,000 bales (of 717 pounds, or nearly two ordinary bales) from Egypt. In the United States alone the area of land cultivated with cotton amounts to upward of 20,000,000 acres.

"The report of the valuation commission deals, in the third place, with silk. In 1895 the quantity of raw silk produced and put on the market was 35,000,000 pounds; in 1894, 30,250,000 pounds; and in 1893, 33,000,000 pounds. Europe and Asia Minor supplied from 35 to 36 per cent. of the whole, the far East from 64 to 65 per cent., but China is still the chief exporting nation for this raw material, having sent out in 1895 13,500,000 pounds. Japan is progressing rapidly; she produces already as much silk as all the European countries together, and is continually increasing her mulberry plantations. Although the yield increased in 1895, there was also a very evident rise in prices. For some time silk manufacturers have been making great progress in the United States, and the establishments of that country, according to the report, are in the first rank as regards the amount of silk worked up, viz., 9,372,000 pounds, as against 8,008,000 pounds in France, 5,610,000 pounds in Germany, 3,652,000 pounds in Switzerland, and 5,610,000 pounds in Russia.

"With regard to flax, hemp and other materials, the report does not state the amount of production at the disposal of the industries of the world, owing doubtless to the difficulty of obtaining information on this point. The production of flax in France has not ceased to decline, in spite of the very high bounties granted, and the area of land cultivated with flax in that country does not exceed 89,000 acres."

CAN THE HAIR TURN WHITE FROM FRIGHT?

The man whose hair has "turned white in a single night" from fear or under strong emotion used to figure extensively in stories and popular tradition. The possibility of his existence has been denied by some, but cases of the kind are too well authenticated to be thrown aside. A contributor to Cosmos (Paris, February 27) details some recent investigations that have been made on the subject, and gives us a physiological explanation of the process, says the Literary Digest.

"Toward the age of forty years, sometimes a little earlier, the hair begins to turn gray. This grayness appears at first in the region of the temples, where threads of silver mingle with the hairs and their number increases day by day; the head turns gray and then whitens. It is a phenomenon of vital regression, common to mammals, and to many animal species. Brown-Sequard has studied its mechanism. The hair turns gray progressively and slowly, but the isolated whitening of a single hair is generally rapid and may take place in one night. This observation of the celebrated physiologist gives some credit to the stories of rapid and even sudden whitening of the hair, told by divers authors. If normally a single hair can whiten in a few hours, it is not difficult to explain that in certain determinate cases the thing can take place with a lock of hair, or even the whole head.

"M. Fere has cited an instance of this in Le Progrès medical (January 23, 1897) and has referred us to the facts published in his well known work on 'The Pathology of the Emotions' (Paris, 1892).

"His memoir has given several authors the opportunity to recall their own observations on the subject, and we shall cite a few cases that seem to bear the stamp of authenticity.

"Dr. Parry, in the Dublin Medical Press, May 8, 1861, gives the following instance:

"On February 19, 1859, the command of General Franks, operating in the southern part of the kingdom of Oude, had an engagement near the village of Chamba with a body of rebels; several of the enemy were taken prisoners; one of them, a Sepoy of the Bengal army, aged about fifty-four years, was led before the authorities to be questioned. I then had occasion, says Parry, to observe in this man, at the very moment when they took place, the events that I propose to relate:

"'The prisoner seemed for the first time to be conscious of his danger when, deprived of his uniform and completely nude, he saw himself surrounded by soldiers. He then began to tremble violently, terror and despair were depicted on his face, and, though he responded to the questions addressed to him, he seemed actually stupefied by fear. Then, under our very eyes and in the space of scarcely a half hour, his hair, which we had seen was a brilliant black, turned gray uniformly over his whole head. A sergeant who had made him prisoner cried out, "He is turning gray," and so called our attention to this singular phenomenon, which we, as well as many others, were then able to follow in all its phases. The discoloration of the hair took place gradually, but it became complete and general in the short space of time already mentioned.'

"With this so precise observation we may compare the assertion of Bichat, who saw one of his friends grow quite white in the space of a single night, after having experienced a violent emotion.

"The unfortunate Queen Marie Antoinette grew almost entirely gray during the night preceding her execution.

"Moleschott relates that Louis Sforza grew entirely white in the night following his defeat and capture, after his campaign against Louis XII.

"A Dutch physician, Junius, tells of a nobleman of high rank who, being condemned to be beheaded, grew gray in one night.

"The same thing happened to the Seigneur de St. Vallier, father of Diana of Poitiers, while Guarini, professor of Greek at Verona, grew gray all at once on learning of the loss at sea of a chest of manuscripts that was coming from Constantinople.

"Thompson cites the case of a workman at York, who, having fallen from a high building that he was repairing, succeeded in holding on to the gutter with one hand. He was rescued, but not until his hair had turned white.

"The cases in which the change of color is not instantaneous, but is very rapid, appear to be most frequent. Bichat relates several. . . .

"Emotional grayness seems to be favored by pressure; when after the shock the subject remains during some time with his head resting on his hand or his arm, the compressed part is often the only one affected, or at least is particularly affected. A case of this kind was related several years ago to M. Fere by one of his patients whose father was a physician. . . . Young O——, then aged five years, was in a carriage with his mother when the horse ran away. He was greatly frightened, but suffered no physical injury. Two days afterward he had an eruption all over his body, without fever; . . . eight days after the accident it was seen that the child had, on the hair of the right side of his head, five white spots, whose position and form corresponded to

the prints of five fingers, and the mother remembered that she had held her hand on the head of her child in this position in endeavoring to protect him. The change of color of the hair was permanent, the spots even increased in size; at present (ten years later) the largest, which is the nearest to the forehead and corresponds to the position of the thumb, has nearly the size of a two franc piece."

After citing several more curious and well authenticated cases of the kind, including some in which grayness was brought on by an apoplectic stroke, the author concludes as follows:

"This grayness following an apoplectic stroke is analogous to the cases that have an emotional cause. These last are not absolutely unheard of among animals. Thus Thompson tells, according to Young, of a blackbird which had been surprised in its cage by a cat, and which, when it was rescued, was found lying on its back and covered with sweat; its feathers fell off and grew in perfectly white. A gray linnet was once seized in its cage by a drunken man who tore its feathers off; the little creature lived, but its feathers grew in again white.

"When the hair whitens, the phenomena that takes place are easily understood, and they have been made a special study by Pincus. The quantity of air contained normally in the hair cavity increases, and at the same time there disappears or diminishes a pigmented oil that is secreted by the hair follicles, and that gives to each hair its characteristic color. It is well known what influence the nervous system has on the secretions and, in general, on the sebaceous glands; it would be surprising if those of the hair should escape this influence, and so the sudden whitening of the hair, whose possibility has sometimes been denied, is explained from the physiologist's point of view."—Translated for the Literary Digest.

CARE OF THE EARS.

THE ears are not often treated of, even in popular manuals of hygiene, probably because it is not thought that much can be done by the owner of the ears to modify or in any way improve them, says the Independent. You go to an aurist, he takes his watch in hand and proceeds to test your hearing, and he talks about "necessary hearing," "superfluous hearing," "good hearing," "normal hearing," etc., while the patient can hardly be made to believe there can be such a thing as superfluous hearing. A few years ago an eminent aurist tested the hearing of twenty-five patients of an eye and ear hospital, who never had suspected that their hearing was not perfect—only five of them proved to have perfect hearing, i. e., that which could be called normal; but the twenty whose hearing could not come up to the "normal" standard had never imagined that there was any deficiency, and so this class of persons are classified as being possessed of "necessary hearing," and they have all that is needed to enable them to perform the ordinary duties of life.

It is surprising how many of the persons who consult the aurist are relieved by simply having a mechanical obstruction removed; either an accumulation of wax or a wad of cotton that has been put in at some long forgotten time when the patient had an attack of earache. When there is an accumulation of wax it usually follows measles or scarlet fever and is easily removed by dropping a little sweet oil in the ear, allowing it to remain till the wax is softened and then syringing the ear, preferably with a douche from a fountain syringe; but if a person is out of range of this excellent appliance, a very good substitute can be improvised by filling a quart bottle with warm water (as hot as can be borne) and attaching a sufficient length of rubber tubing to its mouth, inverting it and allowing the water to flow through the tubing to the ear. In the case of impacted cotton wads the course of action is generally this: The person takes cold, the membranes of the ear become swollen and sensitive in sympathy with the throat, but the patient has his attention fastened on the ear, and to protect it he inserts the cotton. In a few days the inflamed membranes of his nose and throat become normal, the sensitiveness of the ear is forgotten and the cotton remains; but the man says: "In fact, I've never heard well since I had that terrible cold five years ago." It is simply a mechanical obstruction that he is suffering from.

An experienced aurist raises the note of warning against the use of ear spoons, ear sponges, etc., that are to be found in any druggist's shop. He denounces them as worse than useless—as often the active agents of irreparable harm. He says there is more wisdom than humor in the old adage "Put nothing in your ear but your elbow." The end of the little finger wrapped in a handkerchief is allowable, but nothing else.

The deafness from accumulated wax is generally sudden, and is accompanied by a dull, rumbling sound, and it should at once be carefully looked at and treated by a competent observer.

We have been hearing a great deal lately about "preventable blindness," and it is a matter of devout thankfulness that the thousands of blind infants that have swelled the ranks of the dependent classes will now be saved by the immediate Crede treatment—especially in those States which have enacted laws to punish the ignorant neglect of unintelligent nurses and midwives, who do not realize that while they are pottering with tea leaf dressings a hopeless curtain of opacity is spreading over the cornea, while the proper application of nitrate of silver would arrest the mischief. The attendants at our eye infirmaries say it is most pitiful to see the mothers of children three and four weeks old, who bring the children with cornea gone, and are told that the time to save the sight was before the child was seven days old.

Now as to "preventable deafness"—for the aurist tells you that most of the deafness which robs people of much of their "necessary hearing" is not primarily dependent on the ear at all—the real cause is to be found in a swollen and inflamed condition of mucous membrane that lines the upper portion of the nostrils and the back part of the throat; and of course the point to which efforts to improve the hearing should be directed is the membrane lining the nostrils and throat. The man who tested the defective ears—Dr. A. M. Fanning—deprecates the snuffing up of salt or salt water from the hand as is often done, and recommends instead a solution of common baking soda (bicarbonate of soda) both as a gargle for acute sore throat and as a wash for the interior of the nose itself. He says: "It is a great mistake forcibly to snuff it into the nostrils from the palm of the hand, as is commonly done. . . . The best and simplest way to use the soda solution is to bury the nose entirely in the cup of fluid, and then gently suck the solution into the nose, at the same time holding the mouth widely open. There is no risk of choking if the mouth is open and the head thrown forward, for all the fluid will run out at the mouth. Careful attention to the general health, all judicious measures of exercise, a diet that will insure sound blood—counteracting inflammatory tendencies—and, above all, care to avoid taking cold, is the true 'treatment.'"

TETANUS ANTITOXIN.*

ONE by one the diseases which have hitherto defied the skill of physicians are yielding to the persistent attack of modern science. Since the successful treatment of diphtheria by subcutaneous injections of antitoxic serum was demonstrated—hardly three years ago—it has been confidently predicted that sooner or later all diseases which result from the action of a poison secreted in the blood by a special and characteristic bacillus would be conquered by similar means.

From the evidence now presented, it would appear that tetanus, one of the most sinister and stubborn of human maladies, if not already conquered, is in a fair way to be successfully overcome. In the Deutsche Medicinische Wochenschrift (Berlin) for October 23 appears a joint announcement by Prof. Dr. Von Behring, of diphtheria antitoxin fame, and Prof. Knorr, of Marburg, describing the qualities and best methods of using the new tetanus antitoxin, which is now prepared under government supervision as a commercial product by the Farbwerke at Hoechst-on-Main, and offered for use by medical practitioners under the same conditions as diphtheria antitoxin from the same source.

Tetanus, as is well known, is an exceedingly painful and hitherto usually fatal disease caused by blood poisoning, generally the result of a wound. It is believed by physicians to be caused by the introduction into the system of a minute organism which rises from the ground in certain localities, so that the prevalence of tetanus varies greatly even in different districts of the same country. At all events, the disease has its characteristic microbe, which has been recognized, isolated, described and reproduced by artificial culture. The distinctive symptom of tetanus is a persistent spasm of the voluntary muscles, aggravated by light, noise or other disturbing influence to which the patient may be subjected. These spasms may affect any muscular portion of the body, but when, as is often the case, the maxillary muscles are principally attacked, the resulting malady is known as lockjaw.

The tetanus antitoxin described by Prof. Behring and Dr. Knorr is similar in nature, action and in the methods of its preparation to the antitoxin of diphtheria. It is prepared and put up for use in two forms, viz., as a dry powder, which is used for the treatment of developed cases of tetanus in men and animals, and as a liquid solution, which is employed for prophylactic purposes. Its strength or degree of efficiency is measured, like that of antidiphtheritic serum, by antitoxic units. The dry antitoxin is designated as a hundredfold normal antitoxin—that is, 1 gramme of the preparation contains 100 units of antitoxic power; in other words, is sufficient to neutralize 100 grammes of the normal poison of tetanus. It is put up for commerce in vials containing 5 grammes each, and the contents of one such vial are theoretically sufficient for the cure of a developed case of tetanus. It is dissolved in 50 cubic centimeters of sterilized water at a temperature of 40° C. and injected hypodermically at a single dose. In the treatment of horses, the injection is made into a vein, by which the full action of the antitoxin is accelerated by about twenty-four hours, and this method of injection may even be employed with human patients in very severe cases or where the treatment is commenced at a late and perilous stage of the disease. To insure favorable results, the injection should be made, if possible, within thirty-six hours after the presence of tetanus is definitely indicated. The liquid solution is protected from contamination by germs in the atmosphere by a small admixture of phenol. The dry preparation, on the other hand, requires no such antiseptic while in that form, but when dissolved in water it becomes subject to deterioration, which may be prevented by the addition of one per cent. of chloroform.

The tetanus solution is of fivefold strength, that is, 1 gramme of the liquid contains five antitoxic units, and in this form it is put up in sealed 5 gramme vials. In presence of wounds which give reason to fear lockjaw or other form of tetanus, a small subcutaneous injection of the solution is made, the quantity used being proportionate to the condition of the patient and the time that has elapsed since the injury was received. In all cases the wound should be antiseptically treated, so as to prevent as far as possible the further generation of poison in the blood.

Tetanus is a disease of seldom occurrence in this section of Germany, and opportunities to test the remedy in actual practice are comparatively rare. One such case has been recently treated at the hospital of the Holy Spirit, in Frankfort, the record of which is officially and minutely given.

On September 19 last a coppersmith (L. M.) twenty-five years of age and resident in Frankfort experienced, after exposure to thorough wetting, severe pains and stiffness in the muscles of the neck and throat. Two days after the first symptoms appeared he came under treatment by a physician, who kept the patient in bed and administered chloral and salicylate of soda. The symptoms of tetanus continued to develop, and on the night of September 29 became so marked and violent that on the following day the patient was transferred to the hospital. A careful examination revealed a small cut or scratch under the right ear, then nearly healed, and so slight in outward appearance that it had passed almost unnoticed. At the time of admission to the hospital the patient was growing rapidly worse. The chin was twisted far to the left, the head drawn backward and immovable and the muscles of the body, especially the back and abdomen, were hard and tensely drawn. The patient was isolated in a dark room and treated with subcutaneous injections of morphine, which gave no relief. The slightest noise or disturbance, such as the entrance of the physician or nurse into the darkened room, induced severe spasms, and the condition of the sufferer continued to grow steadily worse. At 4 o'clock in the afternoon of October 1 a prolonged spasm of intense severity left no further doubt of a fully developed case of tetanus, and half an hour later 5 grammes of the hundred-unit antitoxin, dissolved in 50 grammes of water, were injected hypodermically at three places on the breast.

During the evening of the same day a slight but definite improvement was observed, and this continued throughout the following day, the spasms being fewer and of shorter duration than before the antitoxin had been administered. This condition was maintained from October 3 to 6, when the acute symptoms gradually returned, and by 9 o'clock in the evening became so severe that a second dose of 4 grammes of normal antitoxin was administered as before, with the result that before the next morning the muscles began to relax, the spasms became lighter and less frequent and from that time improvement was so rapid and sustained that on October 23, sixteen days after the second injection of antitoxin, the patient was convalescent, and, at his own request, was discharged from the hospital.

This, in the opinion of the physicians in charge, was a typical and conclusive case, in which life could not have been saved by any other treatment previously known, and in which the course of the disease might unquestionably have been arrested and greatly shortened had the antitoxin been used when the patient first came under medical treatment, instead of ten days later, when the case had become one of acute and fully developed tetanus.

It is, of course, too soon to estimate the exact prophylactic or therapeutic value of the new remedy. That can only be determined by a long series of observations in actual practice, which will be made as rapidly as the comparative rarity of the disease itself will permit. Thus far the antitoxin has been used experimentally, both in this country and in France, with horses, cattle, guinea pigs, mice, etc., and from these tests and the hospital case above described the indications are that its use entails no injurious result. The antitoxin is prepared with extreme care, subjected to rigid inspection and control at the imperial testing laboratory at Steglitz, and with this guarantee is placed within reach of bacteriologists and medical practitioners in all countries.

FRANK H. MASON,

Frankfort, November 16, 1896. Consul-General.

* U. S. Consular Reports.

THE POISON OF SUNSTROKE.

DR. IRA VAN GIESEN, director of the State Pathological Institute, at Madison Avenue and Twenty-third Street, contributes an interesting tentative review of the investigation and experiments into the nature of sunstroke made in this city during the heated term last summer to the State Hospital Bulletin, recently issued. The experiments attracted widespread attention at the time, since they involved the study of sunstroke from the standpoint of physiological chemistry, from which aspect the disease had previously received but little attention from the medical world.

Dr. Van Giesen believes that the investigations have established the auto-toxic nature of the disease. He considers it remarkable that sunstroke has not received more attention from that standpoint, because of the tendency of many authorities to place diseases in the category of auto-intoxications when they have comparatively insecure proofs.

He describes sunstroke as "a brilliant example of an acute, intense, and virulent poison originating within the body, acting rapidly and violently upon the nervous system." He became convinced that the acute degeneration of the cortical cells was due to the action of a poison, and the outbreak of the affection in this city afforded excellent opportunities to substantiate, if possible, that theory. The results obtained from experiments showing the effects of the body fluids and excretions of living cases of sunstroke upon animals are described in detail.

Repeated injections of urine in rabbits from several different cases showed uniform hypotoxicity shortly after the sunstroke occurred. Injection of the cerebrospinal fluid and ventricular fluids taken from the brain of fatal cases showed lethal results in some animals. These experiments, however, are not considered to have much significance, since the animals died when not under observation, some hours after the injection.

Prompt and decisive results were obtained from injections of blood serum taken from patients during the period of what is known as hyperpyrexia. These experiments were noteworthy and are described at much length. Although Dr. Van Giesen has noted fatal results in some such cases which could not be attributed to the injection of the material, he believes that there "was no mistaking the cause of death which occurred so uniformly in these animals in succession. This result is in consonance with the hypothesis that the rapidly fatal course in severe cases of sunstroke is due to an intense, rapidly acting poison, circulating in the body fluids. If this view be correct, it was to be expected, as was in fact the case, that even the small quantity of blood serum used in the rabbits would produce experimentally this rapid, prompt and fatal effect."

Other experiments involving the injection of urine from convalescing patients into the blood circulation of rabbits were also attended by interesting results. Dr. Van Giesen thinks that "it is not too much to say that the virulence of the auto-toxic poison in some cases of sunstroke is fully as rapid and violent as snake venom, and considerably resembles its action. Cases of sunstroke which entered the hospitals with purple, swollen faces, rapid and very much enfeebled heart action, and profound collapse, with death occurring within one to two hours, are surely examples of the effects of the most violent poisons that we know of. Such a poison seems immediately to act upon the ganglion cells which govern the heart and which manage the vasomotor apparatus. This brings about such a rapid suspension of the most vital functions that the body hardly has a chance, so to speak, to react against or eliminate the poisons."

Switzerland's National Council has voted unanimously to make insurance against accident and sickness compulsory on all citizens.

SPITZBERGEN.

Our readers may have wondered how it is that we are kept so well informed about the proceedings at remote Dane's Island (near Spitzbergen), the starting point of Andree's north polar expedition. But Spitzbergen, however far from civilized domains, is not by any means without all culture.

Within the last twelve months it has been brought into close union with the European continent by the opening of a Norwegian steamship line from Hammerfest to Advent Bay. This latter port lies on the western coast of Spitzbergen, on one of the finest and largest fiords of the island. For some years there has of course been a considerable amount of traveling to and from Spitzbergen, but the opening of the steamer line has given the island a place among the innumerable places accessible by regular service accommodations. Besides, the company has built a hotel, where the travelers may settle down in comfort, or at any rate find shelter at any time. Norway has provided Advent Bay with a post office, so that little far north settlement now stands in direct union with the Continent, both as regards traveling and mail.

Hammerfest lies farthest north of all European towns. In spite of its seclusion from other townships, it has for some time been supplied with electric lighting.

The cause of this early development lies in the peculiar circumstances which place Hammerfest in unusually great need of good lighting; for two months in the year the sun sends not a ray of light on the town.

From Hammerfest then the boats run to Spitzbergen. Hammerfest itself must be reached by boat, not being in connection with any other Norwegian town by rail.

For centuries Spitzbergen has only been accessible to a few explorers, whalers, Arctic hunters, etc., but now it is open to all. The postal connection will no doubt do a great deal toward increasing the number of tourists visiting the island.

The late successes of Nansen in particular are strong motives with many for a journey to the Arctic regions. Spitzbergen is certainly the most appropriate of all northern territories for tourists. With its rich Arctic flora and fauna, and its glittering glaciers, it offers all the charms of a polar journey, while under the existing circumstances it is easily reached. In a little more than two days the traveler is taken from Hammerfest to Advent Bay; here he finds small steamers under the guidance of experienced captains, ready for occasional trips for seal hunting and Arctic sport.

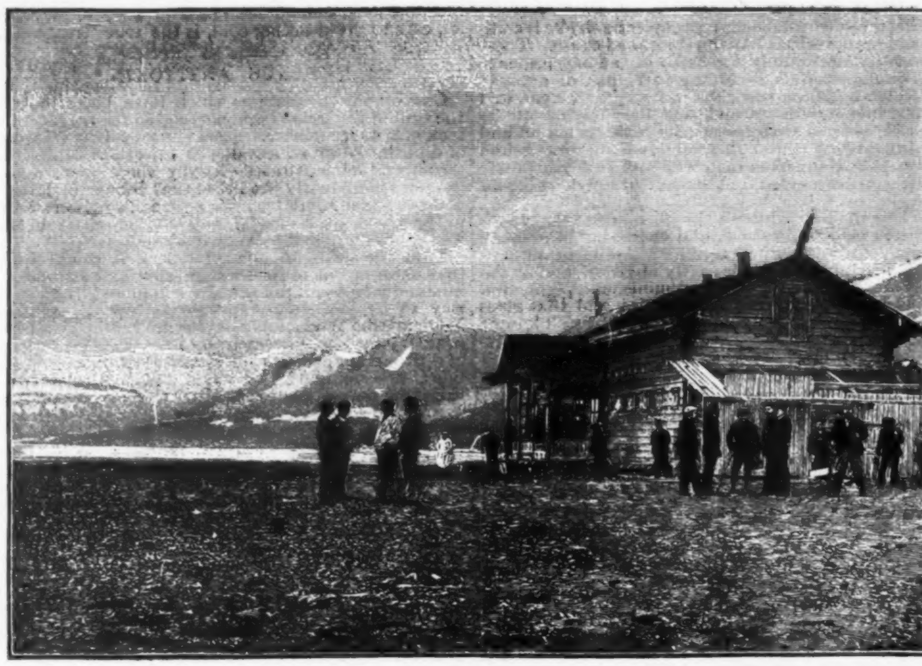
In these seas there was once an abundance of whales, but whalers of all nations, especially Englishmen, Dutchmen, Hanseates, Baskes and Danes, played such havoc among those great sea mammals that at the beginning of this century their pitiless slaughter, begun soon after the discovery of the island in 1596, had exterminated the whales from those waters. Still the island was frequented, even after that, for its elks, bears, and other furred beasts, and mainly by Russians. At present the western and northern shores of Spitzbergen are struck by Norwegian sailors, to secure furs of the polar bear, to hunt the elks, the seals and eiders. These hunters have thrilling tales of adventure to tell, which must be taken with a grain of salt. Still the danger of a forced hibernation in those regions, with provisions calculated for a much shorter period, is by no means to be made light of. Sometimes masses of ice block the retreat from Spitzbergen in autumn, and the men have to wait till spring to return. In most cases no precautions are taken for such emergencies, and the adventurer who escapes with his life can consider himself fortunate. That a hibernation on Spitzbergen with the necessary provisions is not such a very serious matter is clearly shown by the example of the Russian Staratschin, who spent a large portion of his life on the island. At Green Harbor, a part distinguished by its striking beauty of nature, he spent thirty winters on the cape bearing his name, and of those thirty, fifteen in succession. He died there of old age. To the present day the name of this patriarch of Spitzbergen lives among the Arctic seafarers.

If a stay on Spitzbergen in the long polar night, in spite of the beautiful northern light, involves many discomforts, the summer is all the more charming.

In the vales and lowlands the sun's warm rays soon melt away the snow, and vast expanses of moss and lawn covered ground are soon gay with animal life. On the ice along the shore, too, blue and white foxes and other Arctic animals can be seen. Here the passionate hunter can enjoy such hunting as few other spots on the earth can afford. Polar bears are mostly seen in spring in the fiords, but occasionally one is sighted in summer too.

Under such circumstances it is not to be wondered at that the train of tourists to the island is steadily increasing, particularly now that the traveling accommodation and mail connection to Spitzbergen have received the great improvement which we mentioned at the beginning of our article.

It may be interesting to our readers to hear that the boat which takes you from Hammerfest to Spitzbergen is under command of Otto Sverdrup, the man who has become famous for his successful navigation of the Fram, the ship that bore Nansen and his company on their Arctic expedition.



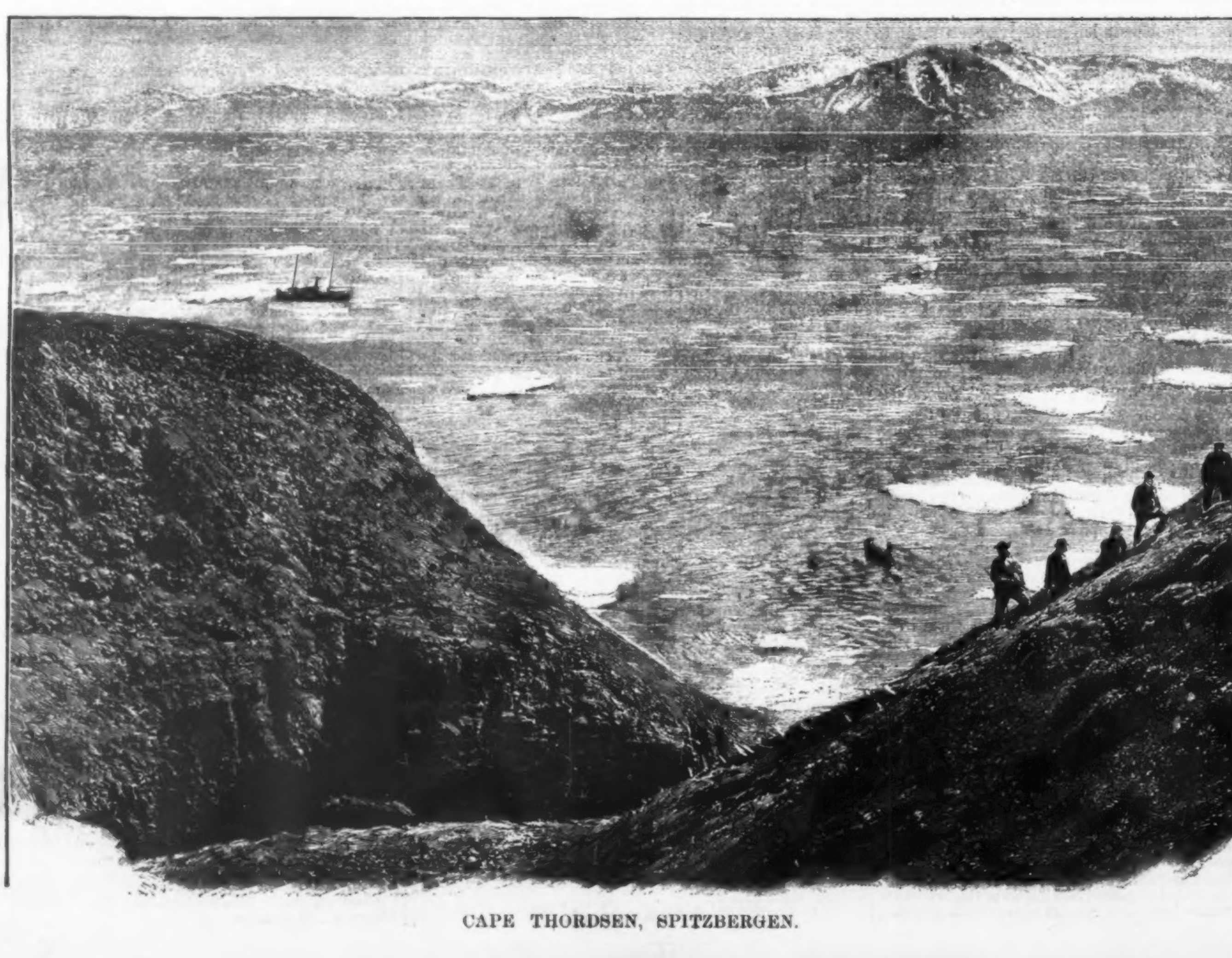
HOTEL AND POST OFFICE, ADVENT BAY, SPITZBERGEN.

This information about the little island in the distant northern seas will, we hope, be welcome to our readers at a time when the newspapers have just announced the departure of Andree on his aerial journey poleward.

Our illustrations, which show several spots of special interest and beauty on Spitzbergen, are taken from Ueber Land und Meer.

BEES AS WEAPONS OF WAR.

History records two instances, according to Mr. Whiteley Stokes in the London Athenæum, in which bees have been used in warfare as weapons against besieging forces. The first is related by Appian, of the siege of Themiscyra in Pontus, by Lucullus in his war against Mithridates. Turrets were brought up, mounds



CAPE THORDSEN, SPITZBERGEN.

were built, and huge mines were made by the Romans. The people of Themiscyra dug open these mines from above, and through the holes cast down upon the workmen bears and other wild animals, and hives or swarms of bees. The second instance is recorded in an Irish manuscript in the Bibliothèque Royale, at Brussels, and tells how the Danes and Norwegians attacked Chester, which was defended by the Saxons and some Gallic auxiliaries. The Danes were worsted by a stratagem; but the Norwegians, sheltered by hurdles, tried to pierce the walls of the town—when, "what the Saxons and the Gaeidhil who were among them did was to throw down large rocks, by which they broke down the hurdles over their heads. What the others did to check this was to place large posts under the hurdles. What the Saxons did next was to put all the beer and water of the town into the caldrons of the town, to boil them and spill them down upon those who were under the hurdles, so that their skins were peeled off. The remedy which the Lochlans applied to this was to place hides outside on the hurdles. What the Saxons did next was to throw down all the beehives in the town upon the besiegers, which prevented them from moving their hands or legs from the number of bees which stung them. They afterward desisted and left the city."

THE ARMY WORM.

By CLARENCE M. WEED, New Hampshire College Agricultural Experiment Station, September, 1896.

EARLY in July complaints began to reach the Experiment Station of the injuries inflicted by the army worm* upon grain and grass fields. Whenever specimens were submitted, they proved to be the true army worm. Serious injury, especially in barley fields, was done during July; and again in September, when another brood of worms had developed, especial damage was reported to be done in fields of Hungarian grass. As soon as the first outbreak was reported, I visited the infested fields, studying the worms at work, and bringing specimens to the station, where they were placed in breeding cages to determine their life histories. The results of these and subsequent studies, as well as a summary of our knowledge of the insect in general, are embodied in this bulletin.

The army worm is believed to have occurred in New England as long ago as 1743, a year when, according to early records, there appeared "millions of devouring worms in armies, threatening to cut off every green thing." The pest was also present in great numbers in New Hampshire, in 1770. There is little evidence of its again occurring in New England in great abundance until 1861, when it was very destructive, as it was also in 1875. The last serious and widespread outbreak in New England appears to have been that of 1880. The army worm is generally destructive in seasons following years of unusual drouth. It is seldom injurious in a given locality for two successive summers, but it is worth while to burn over—in autumn, winter, or spring—fields where it may be present.

The story of the life of the individual army worm may be briefly told. On some summer night there appears in the meadow a good sized light brown moth. Flying about, she finds a cluster of strong growing grass. Into the folded leaves of one or more of these she pushes a number of small whitish eggs, gluing them in rows of a dozen or more. A week or ten days later each egg hatches into a minute, whitish worm, that nibbles at the grass blades at night and in the daytime hides beneath the grass from the rays of the sweltering sun. It grows rapidly in size. At the end of a week it moults or casts its skin, a process in which the old skin splits open along the back, and the worm crawls out, clothed in a new skin that had developed beneath the old one. Again it feeds as before, its voracity increasing with its size. This moulting is repeated four or five times during the month after the worms hatch, so that by the end of this period the insect is an inch and a half long, and has the familiar markings of the full grown army worm.

The instinct of the worm now teaches it to seek more secure shelter for the helpless stage upon which it is about to enter. It burrows into the soil an inch or less and wriggles about in the earth until it produces a hollow cell. In this it casts its skin again and becomes a pupa—the third stage of its existence. When the worms are very abundant, many of them do not go into the ground, but change to pupæ beneath whatever shelter may be at hand. About a fortnight later another change takes place, and the fully developed moth emerges from the pupa, thus completing the round of the insect's life. The moths fly toward dusk and at night, and by means of their long tongues, coiled up when not in use, they suck the nectar of various flowers. The moths sometimes seem attracted by buildings. I have been told of their swarming toward the close of cloudy afternoons about barns and outbuildings; and early in August, this year, they were trapped by thousands in the projecting porch of Thompson Hall. We killed one thousand of these moths, placed them in a little heap, and photographed them. The photograph is reproduced in Fig. 1. It represents the moths about one-half natural size, and seems a small pile, but had the moths not been killed there might have developed from them in September nearly half a million army worms.

During ordinary years the army worm is present in most of the regions where its outbreaks occur, individual worms feeding here and there in meadows and pasture lands, but the number is not sufficient to attract notice. At such times their habits of life are very similar to those of the common cutworms, to which, indeed, the army worms are closely related. It is only when these insects become so excessively numerous that they exhaust the food supply of the field in which they develop that the "army" habit is assumed. Then, however, they are forced to seek new quarters for food, and as their only mode of progress is by crawling along the ground, they move in solid masses toward adjacent fields. "Their numbers at these times," wrote Dr. C. V. Riley, "are often so enormous, and their voracity so great, that it is impossible for one who has not been an eye witness to appreciate it fully. . . . The army worm when traveling will scarcely turn aside for anything but water, and even shallow watercourses will not always check its progress, for the advance columns will often continue to rush headlong into the water until they have sufficiently choked it up with their dead and dying bodies to enable the rear guard to cross safely over. I have noticed that after crossing a bare field or bare road where they are subjected to the sun's rays, they would congregate in immense numbers under the first shade they reached. In one instance I recollect their collecting and covering the ground five or six deep all along the shady side of a fence for about a mile, while scarcely one was seen to cross on the sunny side of the same fence."

The army worm feeds by preference upon plants of the great grass family, which includes both the grasses and grains. The moths are especially attracted, for the deposit of their eggs, to rank growths of grasslike plants. To this is due the fact that in New Hampshire this year the brood of worms destructive in July was oftenest found in barley fields, while that destructive in September ravaged the fields of Hungarian grass. In feeding upon timothy and similar grasses the leaves are first stripped, and in cases of severe attacks the heads will be wholly or partially gnawed off; one such is represented in Fig. 7. They also feed freely upon the leaves and more or less upon the succulent stalks of wheat, oats, barley, rye, sorghum, and Indian corn. Generally they feed upon clover only when driven to it by hunger.

Apparently there were three broods of worms in New

* Leucania unipuncta.

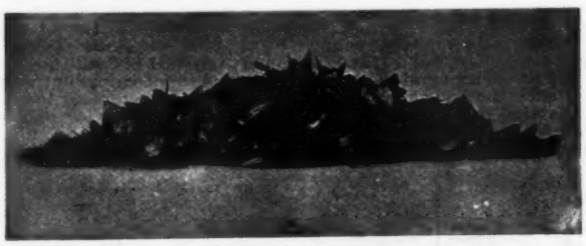
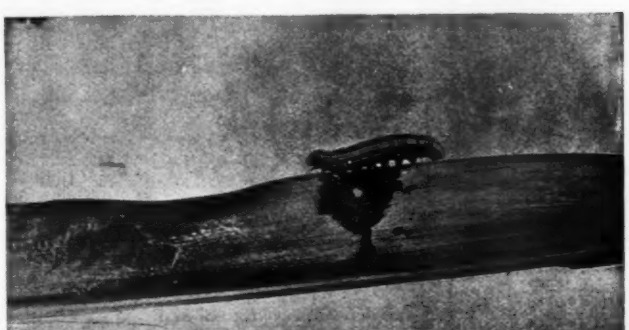
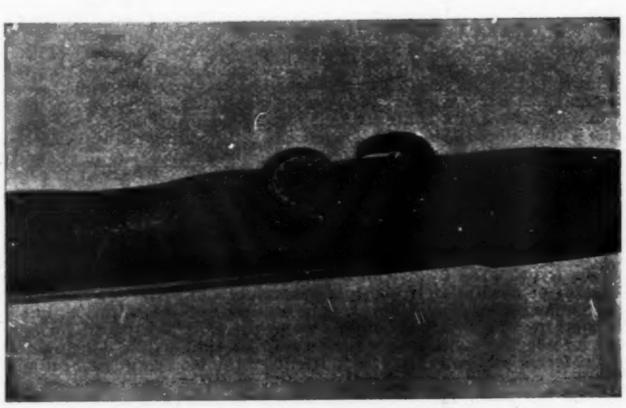


FIG. 1.—A Thousand Army Worm Moths.





FIGS. 2 AND 3.—Photographs of Army Worms.

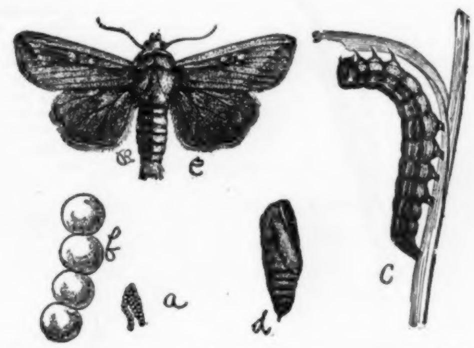


FIG. 4.—a, egg mass, natural size; b, eggs, magnified; c, full grown larva; d, pupa; e, moth. (After Riley.)

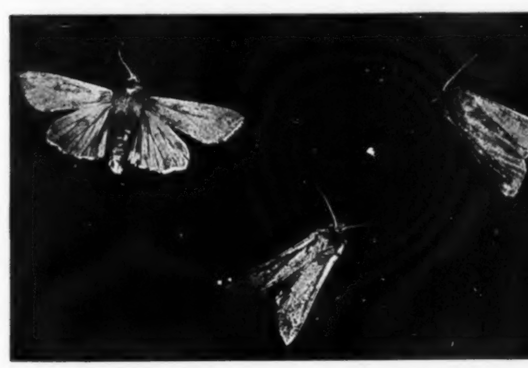


FIG. 5.—Moths of Army Worms, Natural Size.

FIG. 6.—Army Moths Entrapped in Spider's Web.

THE ARMY WORM—VARIOUS STAGES OF ITS DEVELOPMENT.

Hampshire this season. Before the destructive brood that appeared in July there must have been a brood developed during late spring or early summer. Some members of this generation, and perhaps most, probably passed the winter as partially grown worms, while others may have wintered over in other stages of the insects' existence, for the broods are by no means definitely limited. In a given field at a given time one may find many sizes of worms. The worms injurious in July were doubtless the second generation for the season. The majority of these entered the pupa state during the middle or latter part of the month and emerged as moths early in August. The progeny of this brood of moths became full grown larvæ in September, changing to pupæ late in the month. It seems almost certain that many of the pupæ must go through the winter without changing to moths; and that many of the moths must hibernate without laying eggs.

The egg of the army worm moth is a tiny whitish sphere with a diameter of only about one-fiftieth of an inch. When first deposited it is dull and opaque, but soon afterward it becomes shiny and more or less irides-

Fig. 7.—Head of Timothy Grass Gnawed by Army Worms. (Original.)

cent. Just before hatching it appears much darker. The spherical outline in many specimens is changed by the sticky material attached to them at the time the eggs are deposited. Specimens, natural size and magnified, are represented in Fig. 4, a, b.

The larva when full grown is of the form represented in Figs. 2 and 4 c. It is a smooth, cutwormlike caterpillar, an inch and a half long, generally of a dark gray or dingy black color, "with three narrow yellowish stripes above and a broader one or slightly darker on each side, thinly clothed with short hairs (to be seen with a lens) which are longer and somewhat thicker on and about the head. The latter is of a polished honey yellow color, with a network of fine dark brown lines and a black line on the front like the letter V reversed." The size of the mature worms varies considerably, some specimens reaching a length of two inches.

The pupa into which the full grown army worm changes before it can become a moth is represented in Fig. 4 d. It is a quiet, footless, wingless object, of a bright mahogany brown color, and measures about three-fourths of an inch in length. At the smaller end

Fig. 8.—Black Ground Beetle. (After Riley.)

there are two pointed projections side by side, and near the base of each projection is a smaller, more slender spine with a hooked tip.

The adult moth into which the army worm develops, and from the eggs of which it originates, is represented, natural size, in Figs. 5 and 4 e. Its expanded wings measure about an inch and a half from tip to tip, although there is considerable variation in the size of different specimens. The general color of the body and front wings is a peculiar reddish gray, perhaps more distinctly described as fawn color. Near the middle of each front wing are two more or less irregular lighter patches, each of which on closer study is seen to be made up of three smaller spots. Along the side margins of both pairs of wings there is a fringe of feathery scales, immediately inside of which, on each of the front wings, is a row of blackish dots. The hind wings are more grayish, with less of the reddish tinge.

Fortunately for the American farmer, the army worm has a host of natural enemies, which generally keep it below the danger line. A large number of birds consider the worms excellent eating, and feed freely upon them. A list of such birds would include nearly all our native insectivorous species that search for food upon the ground, but special mention should be made of the robin, the blackbird, the bobolink and the meadow lark, which search grass lands for insect larvæ more persistently than many other of our common birds. These and other birds are very useful in keeping army worms and cutworms in check, and should be encouraged by every one.

But the birds are not the only enemies of the army worm. In the fields where the pest has been present this season there have also been found a great many large black beetles, some of them similar to the one represented in Fig. 8, and others somewhat larger.

There are also many species of internal parasites that prey upon the army worms. Among the most abundant of these are certain two winged flies that glue eggs upon the backs of the worms. The eggs hatch into tiny footless maggots, that enter the bodies of the worms when they hatch, and develop inside at the expense of their unwilling hosts. Finally they kill the worms and the maggots change to pupæ, from which they soon emerge as flies. These are called tachina flies. There are several species of four winged ichneumon flies that have a similar history, and are often very destructive to the hosts of army worms.

The larger ground spiders also feed freely upon these worms; and the moths are often entrapped in the webs of the spinning spiders (Fig. 6).

To the action of these various natural checks is doubtless due the seemingly strange appearance and disappearance of this vexatious pest. Nature strives ever to keep a balance in her affairs, and when an insect becomes too abundant, she marshals her various forces to bring it into subjection.

When an outbreak of army worms is first noticed, if it is confined to a limited area, it is generally well worth while to cut down the grass or grain infested. The worms will remain beneath its shelter for two or three days, and as soon as the cut grass or grain is dry enough it should be burned, thus destroying the pests and preventing the invasion of neighboring fields. The worms may also be destroyed by spraying them with strong kerosene emulsion. This is prepared by adding 2 gallons of kerosene to 1 gallon of a solution made by dissolving ½ pound of hard soap in 1 gallon of boiling water, and churning the mixture by forcing it back into the same vessel through a forcepump with a rather small nozzle, until the whole forms a creamy mass, which will thicken into a jellylike substance on cooling. The soap solution should be hot when the kerosene is added, but of course must not be near a fire. The emulsion thus made is to be diluted before using against the army worm with five or six parts of water to one part of emulsion. The amount of dilution varies with different insects. Soft water or rain water should be used in diluting. If this cannot be obtained, add a little lye or bicarbonate of soda. It should be applied with a spray pump or nozzle.

The device of stopping the armies of traveling worms by means of ditches and trenches occurred to the earliest sufferers from their depredations. In the New Hampshire outbreak of 1770, Mr. Powers tells us that the inhabitants "dug trenches around their fields a foot and a half deep, hoping this might prove a defense; but they soon filled the ditch, and the millions that were in the rear went over on the backs of their fellows in the trench and took possession of the interdicted food."

Some years ago Dr. C. V. Riley wrote: "From experiments which I have made, I am satisfied that where fence lumber can be easily obtained it may be used to advantage as a substitute for the ditch or trench by being secured on edge and then smeared with kerosene or coal tar (the latter being more particularly useful) along the upper edge. By means of laths and a few nails the boards may be so secured that they will slightly slope away from the field to be protected. Such a barrier will prove effectual where the worms are not too persistent or numerous. When they are excessively abundant, they will need to be watched and occasionally dosed with kerosene to prevent their piling up even with the top of the board and thus bridging the barrier. The lumber is not injured for other purposes subsequently."

One of the simplest ways of preventing injury by the army worm, where it can be done without danger to live stock, is that of dusting or spraying with poison a strip of grass or grain in advance of the invaders. The simplest way of doing this would be to apply Paris green when the dew is on in the morning by means of one of the insecticide bellows now upon the market, designed more especially for use against the potato beetle. We have used two patterns of these this season and found them to do excellent service. One of these, the standard Paris green duster, is shown diagrammatically in Fig. 9. It is an admirable machine, and will distribute a pound of Paris green evenly over an acre of potato vines. The other, called Leggett's insect powder gun, is shown in Fig. 10. It is a slightly larger machine, costing also a little more, but it does excellent work. With either of these machines the poison can be applied much more easily than by any other method.

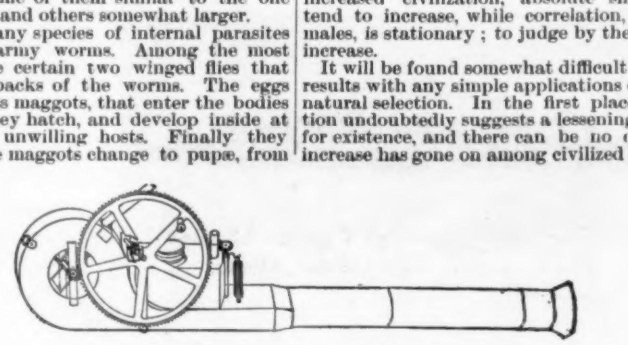


Fig. 9.—Standard Paris Green Duster. (Original.)

Fig. 10.—Leggett's Insect Powder Gun. (Original.)

ON THE RELATIVE VARIATION AND CORRELATION IN CIVILIZED AND UNCIVILIZED RACES.*

The general conclusion would then be that, with increased civilization, absolute size† and variation tend to increase, while correlation, to judge by the males, is stationary; to judge by the females, tends to increase.

It will be found somewhat difficult to reconcile these results with any simple applications of the principle of natural selection. In the first place increased variation undoubtedly suggests a lessening of the struggle for existence, and there can be no question that this increase has gone on among civilized races (see "Variation in Man and Woman"). The lessening of the struggle has probably been greater for woman than man; hence the principle of natural selection might help to explain the preponderance of variability in civilized woman. The increase in size with civilization seems, on the average, also incontestable. But is it the effect of lessening the struggle for existence? The possibilities may, perhaps, be summed up as follows:

(a) The civilized races may have survived owing to their superior size. It may be a result of the struggle in the past. To this must be objected that the increase of size appears to be a progressive change still going on, and yet increase of variation should show a lessening struggle for existence.

(b) The effect of suspending natural selection may be to increase size. This would be a blow for panmixia, for we might naturally have expected a regression to the smallness of the more primitive races. It would leave unexplained the apparently smaller progress of women as compared with men, for in their case we might argue from the variation that the struggle for existence is relatively less than in the case of man.

(c) The larger size of the civilized races may be due to better food supply and better physical training; in short, it may be due, not to evolution, but to better conditions of growth. This hypothesis does not involve the assumption that acquired characters are inherited. Diminish the food supply and abolish physical training, and the size would sink to the level at which natural selection had left it. Physical training in civilized races being usually more adequate in the case of man than of woman would, perhaps, explain why man has progressed more rapidly in size than woman. It seems impossible, taking variation as a measure of the intensity of selection, to reconcile the relative increases in size of man and woman with any direct effect of natural selection.

8. To sum up, then, the following results seem suggested by these measurements:

(i.) Civilized man has progressed generally on primitive man in size, variation and correlation.

(ii.) This progression can hardly be accounted for by increased selection (because of the increased variation), not by decreased selection (because it is inconsistent with the relative changes in male and female size). It might possibly be accounted for by decreased selection and improved physical conditions.

(iii.) Woman is more variable than man in civilized races.

(iv.) Woman is more highly correlated than man in civilized races.

(v.) In uncivilized races the sexes are more nearly equal in the matter of size, variation and correlation than in the case of civilized races.

(vi.) It is impossible to say that civilized woman is nearer to the primitive type than civilized man, for while civilized man differs more from the primitive type than civilized woman, so far, probably, as abso-

* Conclusion of a communication made to the Royal Society.—Science.

† This is only generally true, not in every individual case. The French femur is longer than that of the Aino, of neolithic man, and of the ancient inhabitants of the Canary Islands. On the other hand, the French femur appears to be slightly less than the Libyan, although the humerus is somewhat greater. The French women appear in all long bones less than the Libyan women.

lute size is concerned, he has made only about half her progress in variation, and hardly any progress at all in correlation.

(vii.) The causes (e. g., lessening of selection) which tend to increase variation may also increase correlation. In other words, the intensity of the struggle for existence is not necessarily a measure of the intensity of correlation.*

The measurements made by Mr. Warren on the Libyans, the results of which he has kindly favored us with, are, on the whole, fairly in accordance with the above conclusions. He finds for the—

Mean of the sexual ratio of the means...... 1·092
" " " the variations.. 1·028
" " " the correlations 1·068

The corresponding quantities for the French are: 1·109, 0·939, 0·956, or, we concluded, that in passing from uncivilized to civilized peoples, from Libyan to French, the men gain on the women in size, here very slightly, and the women gain upon the men very markedly in variation and correlation.

These results are merely suggestions, but they may possibly serve to emphasize the importance of a careful measurement of the long bones of, say, 100 members of both sexes for a series of civilized and uncivilized races. In the former case at least there does not appear to be any real difficulty, except the need of co-operation, in obtaining measurements similar to those of M. Rollet, for both English and Germans. The value of such statistics for comparative purposes would be very great.

ALICE LEE,
KARL PEARSON.

* The mathematical theory of selective correlation shows that the close selection of an organ, say the femur, may actually tend to reduce the correlation between two other organs, say the humerus and the radius.

AVALANCHES.

THE causes and effects of avalanches have been known for so long a time that it is unnecessary for us to dwell upon the subject. There are, however, two kinds of avalanches—those that are looked for and those that take place unexpectedly. The former of these are the ones that, as a consequence of the conformation of mountains, have worn away a path that they follow regularly every year and that are called by the name of the place where they fall. Among these, and one of the most important in the region of Davos-Platz, is the one that falls at the place called Schwabentobel (Fig. 1) upon the post road running from Davos to Thusis (Grisons). As such avalanches are expected, methods of defense and relief are provided against them, such as the construction of tunnels or parapets upon the mountain side. Fig. 2 shows what a quantity of snow an avalanche carries with it.

An avalanche that belongs to this category is the one represented in Fig. 3, which falls regularly from the Schwarzhorn behind the hospital of the Fluela (passage of the Fluela from Davos into the Engadine).

These avalanches, being foreseen, generally prove harmless, but such is not the case with those that we place in the second category; for instance, take the one that fell on the sixth of February, 1897, at about a hundred yards from the hospital of the Fluela and buried five men and eight horses. Two convoys were crossing over the road when a formidable noise was heard coming from the Weisshorn Grat. Before a single person could stir, men, horses and wagons were swept away like bits of straw by the wind of the avalanche, and the men and horses probably asphyxiated before being thrown against the opposite wall (Schwarzhorn) and covered by the avalanche.

The snow that fell for four hours covered this scene of horror, and at present we would scarcely suspect that there had been an avalanche at the place where the mail passes. And yet the road is a hundred feet above the true one.

The avalanche was 1,300 feet in width and passed over an extent of about half a mile. At a place where two horses and three men were found the avalanche was from 50 to 65 feet in depth. There are two bodies that have not as yet been found, after a search of more than three months. It is supposed that they are at the bottom of the avalanche, and it will be necessary to wait until the snow melts in order to recover them.

Upon these heights (the passage is at an altitude of 7,870 feet) there are no trees or other vegetation to hold avalanches back, and so their effects are always terrible, and there is not a year passes in which a few deaths do not have to be recorded.

The figures that accompany these few lines reproduce photographs that were taken by M. Sigrist Herder at Davos-Platz. They give an idea of what an avalanche of snow is in the mountains of Switzerland.—M. Picard, in La Nature.

FIG. 1.—THE POST ROAD OVER THE SCHWABENTOBEL BEFORE THE AVALANCHE.

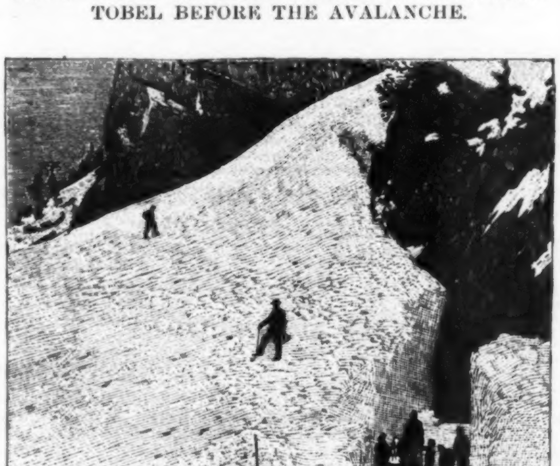


FIG. 2.—THE SCHWABENTOBEL AVALANCHE—THE ROAD OBSTRUCTED.

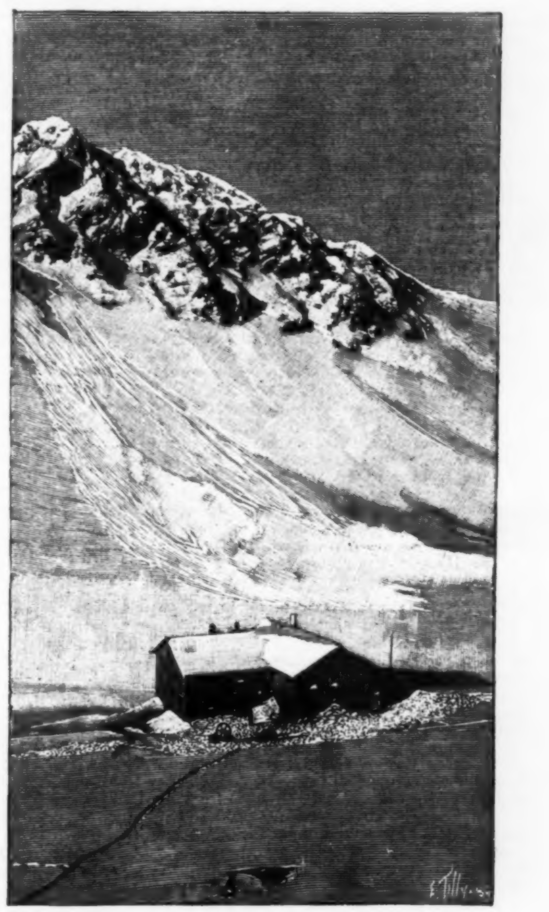


FIG. 3.—PASSAGE OF THE FLUELA—AVALANCHE THAT FELL FROM THE SCHWARZHORN BEHIND THE FLUELA HOSPITAL.

THE PRODUCTION OF PRECIOUS STONES IN 1895.

UNDER this title Kunz* reviews the chief features of the gem industry for the year, giving specially copious details concerning the American production.

A six carat diamond was found at Saukville, Wis., six miles from Milwaukee. In California several diamonds were found, one at Alpine Creek, Tulare County, five near Oroville, Butte County, and about as many more from near the "head of the creek," probably referring to one of the sources of the Feather River. From the association with peridotite, it seems probable that more may be found in this region.

In South Africa the De Beers Company produced diamonds to the value of about $15,000,000 in the year ending July 1, 1895, and the output of the same company for 1896 has been sold for $26,000,000. The total of the dividends paid by the South African diamond companies in the past ten years has been $58,000,000. A 640 carat diamond called the Rietz, found in 1895, is superior in quality to the Excelsior (971 carats) discovered a year or two earlier. The extent of the South African deposits is much greater than hitherto supposed, and many new workings are being opened. Near Winburg, in the Orange Free State, diamond diggings of a prehistoric race were discovered.

Stonier states that the diamonds of New South Wales occur in a Tertiary (?) deposit, and may have been derived from an intrusive mass of peridotite, now serpentinized. They are said to be of better quality than those from South Africa.

The great advance in the price of carbonado, which has trebled in value, has stimulated the search for substitutes. The only source of carbonado is Bahia, Brazil, where a single lump, weighing 3,073 carats, was found during the year. The practicability of using artificial diamonds seems improbable in the light of Moissan's experiments, who has made several hundred crystals with a total weight of about ¼ carat on an outlay of $2,000. This is about 2,000 times the value of natural diamond powder.

Mr. Kunz has named the hydrocarbon to which the phosphorescence of certain diamonds is attributed, Tiffanyite.*

Rubies have been found in place near Franklin, Macon County, N. C., in decomposed gneiss with garnets and chlorite.

Brown and Judd † have recently described the occurrence and methods of obtaining the rubies of the noted Burmese mines, where the paragenesis is much like that of the corundum at Orange County, N. Y., and Sussex County, N. J. In Siam rubies and sapphires have been obtained during the past few years from the Patat Hills. From Black Creek, New Zealand, rubies are also reported. Sapphires and a few rubies are gotten by sluicing the detritus of a decomposed limestone in Fergus County, Montana. The outlook in this locality is promising. The Montana rubies and sapphires are extremely varied in color.

A number of rich green tourmalines were found in 1895 at Mount Mica, Paris, Me. Five of these were cut into gems of from five to fifty-seven carats in weight. At Haddam Neck, Conn., five hundred dollars' worth of tourmalines of various colors were obtained.

Turquoise is reported from Cripple Creek and from Castle Rock Spring, Col. A mixture of prosopite and quartz closely resembling turquoise was found at Provo, Utah.

Unusually fine opals from near Salmon City, Idaho, as well as other occurrences of opal in Idaho, Washington, Oregon, Arizona, California, Colorado and Georgia are mentioned. Australian opals were sold for more than $100,000 in 1896.

In addition to the above named gems, mention is made at greater or less length of andalusite, cyanite, garnet, quartz, amethyst, chrysoprase, plasma, moss agate, labradorite, lapis lazuli, rhodochrosite, realgar, amber, xenotime and monazite.

The total value of the gem production in the United States for 1895 is placed at $113,621, of which $50,000 is accredited to turquoise.—American Naturalist.

* Seventeenth Annual Report of the U. S. Geol. Survey, 1896, pp. 895–926.

* Trans. N. Y. Acad. Sci., May 20, 1895, p. 260.
† Phil. Trans., vol. 187, A, pp. 151–228.

CLOUD AND WAVE STUDIES.

THE old days of blank white skies have practically passed away so far as the walls of our exhibitions are concerned, and even the beginner in photography now desires to obtain clouds either on the same negative as his landscape or on a separate plate. It is not

difficult to obtain clouds at the same time as the landscape, provided a few precautions are taken.

The simplest way to obtain clouds simultaneously with the landscape is to use isochromatic plates with a yellow screen, the sole purpose of the latter being to cut down the strongly actinic blue light from the sky. The particular depth of screen is a matter of judgment, though as a rule the palest tint of commercial screen is quite deep enough for all ordinary clouds, and it is only when the light, feathery cirrus—so well known as the mackerel sky—appears that a darker screen need be used.

Even with ordinary plates clouds may be obtained if a foreground shutter be used—and there are one or two cheap double drop or window blind shutters on the market which are very effective. The only thing to be careful about is to note that the aperture of the shutter is sufficiently large not to cut off the illumination of the corners of the plate. With one of these shutters it is possible, by carefully manipulating the strings actuating the sliding pieces, to give at least four or five times more exposure to the foreground than to the sky, and without the slightest sign of a line of demarkation, provided the sliding pieces are kept on the move. If such a shutter be used with an iso plate and yellow screen, far better results can be obtained, and the yellow screen may be entirely done away with.

When it is desired to obtain clouds on a separate plate, care should be taken not to point the camera too high, and to include, as far as possible, a small portion of the landscape as well. The lens need not be stopped down very much—about $f/11$ or $f/16$ will be quite enough—and with a rapid plate and a shutter working about $\frac{1}{10}$ of a second, good clouds can be obtained. If a yellow screen is used the exposure may be increased to $\frac{1}{4}$ second, or even more if a very dark screen be used, but this is unnecessary unless the clouds are really required for meteorological and not pictorial purposes. Too short an exposure makes it difficult to obtain correct rendering of the sky, just as too dark a yellow screen will have the same effect. On the other hand, too long an exposure will cause the cloud forms, particularly if at all delicate, to be entirely lost. Almost as important as the exposure is the development of the cloud negatives—and care should be taken not to push development too far, so as to obtain too great a contrast, and yet, at the same time, negatives which are too thin will not print well. There is one little point in connection with printing in of clouds, particularly on gelatino-chloride paper, and that is to see that the cloud negative is approximately the same color as the landscape, for, if not, the final tone of the sky will be totally different. This is particularly noticeable when a sky is tinted by sunning down with a card, while the landscape may have been printed from a yellow stained negative.

When we desire to obtain clouds and wave studies combined, it will be found that all the directions given above will be satisfactory. One of the greatest mistakes in the taking of wave studies is to drive the shutter too quick. This means that the wave looks frozen, while with a longer exposure there is some fuzziness which gives one a far better idea of moving water. Even for quickly moving water, less than $\frac{1}{50}$ of a second is rarely required.—Photographic News.

INSANE JOURNALISTS.

"IN several of the English lunatic asylums," says a writer in a French medical periodical, "the management has had the happy and original idea of introducing journalism among the inmates as a curative measure, and according to the reports furnished annually, the innovation has been attended with the best effects. Some of the physicians even declare that in many instances they have been indebted to the lucubrations of their patients for valuable hints as to the best way of treating them. One demented person, for example, obstinately refused to take any food, and with equally invincible stubbornness declined to furnish any reason for his refusal. There was no difficulty, however, in persuading him to commit his thoughts to paper, for apparently the cacoethes scribendi is quite as powerful among people who have lost their wits as it is among those who have contrived to preserve them, and at once this individual's peculiar delusion was made manifest. This is what the hitherto intractable monomaniac wrote: 'I desire to be buried as quickly as possible. It is a monstrous scandal that I should be compelled to drag about all over this house a dead and putrefying corpse.' As soon as the bent of the patient's weak-mindedness was thus brought to light, he received appropriate treatment, and is said to have eventually recovered." The French commentator selects the New Moon, which he justly regards as very appropriately named, for especial commendation, but he omits to say where this journalistic luminary rises. He quotes from it the following passage, which shows, at all events, that a sense of humor is compatible with lunacy: "Wanted for a throne, which it would be indiscreet to specify at present, an emperor or king who is thoroughly conversant with the business. It is quite useless for the Czar of Russia to reply to this advertisement." We may inform our contemporary that journalism by lunatics for lunatics is by no means a novelty in our establishments for the insane. Writing in 1857, Dr. Andrew Wynter said, with reference to Murray's Royal Asylum at Perth: "Not content with these efforts, they seem to think that they are nothing unless critical, and accordingly they have set up a journal in which they review their own performances. The first number of Excelsior is now before us, in which we find poetry, news, and criticisms on music and contemporary literature; and he who reads with the idea of finding anything odd in this production will most certainly be mistaken, for no one could divine that there was a 'bee in the bonnet' of printer, publisher, and contributor." Any one interested in the history of lunacy and its treatment in modern times will find much curious information in Dr. Andrew Wynter's article. It was published, together with several other papers by the same author, by Mr. Robert Hardwicke, of Piccadilly, in a volume called "Curiosities of Civilization"—having appeared previously in the Quarterly Review, says the Lancet.

It is stated by one of the heads of departments of the London and Northwestern Railway that that company issues yearly fifty tons of railway tickets.

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